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ABSTRACT

This module seeks to develop teachers' awareness and understanding of the environmental problem area of energy conservation and resource utilization. It seeks to enhance teachers' understanding of the stewardship approach to resources and the role of the natural system in resource use. Skills in assessing and comparing various energy conservation measures and the application of energy conservation criteria to individual lifestyle decisions are discussed. It also seeks to facilitate teacher development of classroom instructional materials in the utilization of energy conservation resources. (Author/RE)

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ENERGY-CONSERVING RESOURCE UTILIZATION

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SE 028 621

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ENERGY-CONSERVING RESOURCE UTILIZATION

THE THREE MAJOR SECTIONS OF THE MODULE:

INQUIRY	INTEGRATION	APPLICATION
TEXT (SECTIONS 1-6) ACTIVITIES	NATIONAL ENERGY PLAN ENERGY CONSERVATION AND THE INDIVIDUAL HOUSEHOLD	THE PROBLEM CONTEXT GUIDELINES FOR DEVELOPING INSTRUCTIONAL MATERIALS

INQUIRY offers a knowledge base for understanding the nature of a stewardship approach to energy-conserving resource utilization. Activities included here assess the energy-intensive nature of individual lifestyles. Also included are energy-conserving strategies.

INTEGRATION presents two skills development activities which can help the teacher analyze potential energy conservation strategies and recommend specific measures for implementation in a given community.

APPLICATION presents a set of guidelines for planning and implementing instructional programs on Energy-Conserving Resource Utilization.

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During the past decade, there has been a growing public concern over the rapidly deteriorating state of our environment and the threat this deterioration poses for our ultimate survival. This environmental crisis involves a complex and interrelated set of problems which need to be addressed by both community leaders and individual citizens as they make public and personal decisions with respect to a variety of environmental problems. These problem areas include energy production and conservation, mineral and fossil fuel scarcities, food production, water allocation, urban, agricultural, and recreational land use, population dynamics, and pollution.

In order to adequately prepare citizens to meet the long-range planning and decision-making challenges which these environmental problems present, it is the goal of environmental education to develop their skills in: (1) analyzing environmental problems; (2) examining the pro and con arguments of a variety of public and private interest groups, labor, business, and government organizations; (3) exploring possible side effects of various environmental problem solutions; (4) predicting both short-term and long-term implications of local, state and national environmental programs; (5) articulating personal goals, desires, and lifestyle needs in terms of their aggregate (regional, national, or global) implications for energy use and resource allocation and (6) making long-term lifestyle decisions which are compatible with the requirements for maintaining an appropriate balance between natural system and human system functions.

Developing such capabilities can only occur through well-conceived and meaningful environmental education experiences. Curricula though geared toward people of different ages and societal levels, should have the following in common:

- Environmental education should be holistic and integrated... focusing on and clarifying the complex relationships which exist between natural systems and human systems and examining the components and reciprocal functions of both.

- Environmental education should be transdisciplinary... utilizing information from a variety of fields or disciplines (including the natural sciences, social sciences, and humanities) in order to deal adequately with the natural, social, aesthetic, and ethical dimensions of environmental problems which cut across and extend beyond disciplinary lines.

- Environmental education should be problem-focused and decision-making oriented...involving learners in real environmental problems or issues which are broad enough in scope to have regional, national, or global significance. It should engage learners in values clarification, problem-solving, planning, and decision-making processes which prepare them for dealing with environmental problems affecting both individual lifestyles and societal goals.

These characteristics are consistent with the Environmental Education Act of 1970 (as amended) which defines the requirements for informed, energy-literate, environmentally aware citizens. The Act designated the following as specific areas of concern: population dynamics, pollution, resource allocation and depletion, conservation, transportation, technology, urban and rural planning, environmental quality, and ecological balance.

In real life, these areas or "entities" occur in complex combinations. In fact, it is impossible to find a real life problem that concerns only one of these. For example, it is impossible to imagine a "transportation" problem that is not also concerned with "urban and rural planning" or "environmental quality."

In keeping with this Act, the four modules in this series of environmental education teacher training materials were designed to offer a holistic, transdisciplinary and problem-focused experience for teachers. The four modules are described below:

Optimal Use of Finite Land Resources

> Teachers will use a carrying capacity methodology to examine finite land resources, population dynamics, and available energies that must be in dynamic equilibrium in order to maintain a stable balance between the needs of urban and agricultural systems as they develop and grow, and the needs of the natural system to maintain its ecological integrity.

Energy-Intensive Urban Growth and the Quality of Life

> Teachers will examine the pattern of U.S. urban growth as influenced by economics and other considerations and compare these with considerations for enhancing the quality of life...will examine the potential of current urbanization to reverse its present trend toward high energy costs for urban society decreasing quality of life...will also examine the implications of envisioned future patterns of urbanization on energy costs and the quality of life.

Energy-Conserving Resource Utilization

> Teachers will compare a variety of energy conservation strategies and their contributions toward a stewardship approach to resource utilization and conservation... they will analyze the conservation recommendations of the National Energy Plan and act as a Task Force Committee to propose conservation measures for a local community.

Energy Resource Delivery and Use

> Teachers will examine the role of energy in changing cultural contexts...will study the nature and uses of various conventional and nonconventional energy resources...will examine the dimensions of energy policy making...will evaluate the implications of differing means of energy delivery in terms of technical efficiency, environmental impact, and societal implications...and will apply holistic criteria to the evaluation of an energy policy plan.

This field test version of ENERGY-CONSERVING RESOURCE UTILIZATION is based upon a secondary level environmental education model--with an energy focus--that was developed by the Far West Laboratory in 1977. This model provided us with a guideline and rationale for developing--in this and the other three modules in the series--a holistic understanding of our natural- and human-fashioned environment and for presenting this understanding in the context of environmental issues rather than as a simple presentation of subject matter. Integral to the four modules are the learning processes which allow us to explore the totality of interactions between the systems of humanity and nature and which promote our environmental awareness as citizens.

The contents of this module are restated and organized into goals and objectives which appear in the following chart. The top half of the chart (boxes I, II, and A - F) indicates the broad overall goals of the module and each of its major segments (INQUIRY, INTEGRATION, APPLICATION). The lower half of the chart (boxes 1 - 11, a - r) indicates the specific teacher learning objectives for each section and each major activity of the module. These goals and objectives can serve as performance guides as you proceed through the materials. The chart reappears in its entirety at the beginning of the INQUIRY, INTEGRATION, and APPLICATION segments.

MODULE GOALS AND OBJECTIVES

I. Develop teachers' awareness and understanding of the environmental problem area of Energy-Conserving Resource Utilization.

II. To facilitate teachers' developing classroom instructional materials on the utilization of energy-conserving resources.

A

Develop teachers' awareness and understanding of energy resource utilization as one of our "problems of success."

1. Understand the current energy resource problem in terms of our past dreams and successes.

2. Understand how some energy "experts" would map the energy conservation territory.

a. Understand the events and technological developments that have given rise to our high-energy society.

b. Be able to characterize some selected "expert" opinions on the nature of the energy resource utilization problem.

B

Develop teachers' understanding of the stewardship approach to resource utilization.

3. Understand how attitudes and values contribute to resource utilization policies and practices.

4. Understand certain resource utilization strategies which reflect the Stewardship Worldview.

c. Be able to characterize some past and present aggregate worldviews.

d. Understand the attitudes and values that contribute to the evolution of a Stewardship Worldview.

e. Be able to characterize three sample resource utilization strategies.

C

Develop teachers' understanding of the natural systems role in energy-conserving resource utilization.

5. Understand natural systems structure and processes.

6. Understand the role of natural systems in terms of energy supply and demand.

f. Understand the major cycles and processes of our biophysical life support system.

g. Understand the principles of energetics.

h. Understand availability of energy resources and the environmental advantages and disadvantages of their development.

i. Understand energy resource delivery stages.

j. Understand the extent to which recycling and resource recovery can conserve energy resources.

D

Develop teachers' skills in assessing and comparing various energy-conserving measures.

7. Understand the energy requirements of individual households.

8. Understand some of the institutional barriers to implementing energy-conserving resource utilization policies and practices.

k. Understand the relationship between income and indirect energy usage.

l. Recognize potential areas for conservation at the individual household level.

m. Be able to characterize some "new" economic models.

n. Understand some of the legal and political impediments to implementing an energy-conserving resource utilization policy.

E

Apply energy-conserving criteria to individual lifestyle decisions.

9. Apply the knowledge base acquired in the Inquiry toward the assessment of a proposed conservation strategy and the recommendation of specific energy-conserving measures for a community.

o. Apply critical skills for the holistic evaluation of an energy conservation strategy.

p. Devise an aggregate-level energy conservation plan that includes potential barriers to implementation.

F

To familiarize teachers with the components of an environmental problem or issue and to develop experience in planning holistic environmental education for students.

10. Be familiar with the basic characteristics of an environmental problem or issue.

11. Plan instructional activities for students on Energy-Conserving Resource Utilization by applying a set of guideline criteria.

q. List major topics, concepts, principles and processes associated with an environmental problem and display them in a contextual map.

r. Complete a checklist for planning environmental instructional units or lessons.

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INQUIRY SECTION 1

INQUIRY SECTIONS 2 & 3

INQUIRY SECTIONS 4 & 5

INQUIRY SECTION 6

INTEGRATION SECTION

APPLICATION SECTION

ENERGY-CONSERVING RESOURCE UTILIZATION

BASIC PREPARATION

This Teacher Training Module is designed to be used by a small group of teachers in a self-directed, team learning mode. There is a need, however, for some initial preparations to be made in order to facilitate teachers' completing the module activities and acquiring the necessary knowledge and skills:

- Limit the number of teachers participating in the learning team to between 3-5; this number ensures the necessary level for team learning intensity, individual participation, and group cooperation.
- Select a suitable meeting place, free from distractions and outside interruptions, in which teacher learning activities can occur;
- Locate and assemble all required outside reading materials specified in the activities sections of the module;
- Reproduce these outside reading materials to prevent teachers from having to "wait around" for others to finish them;
- Arrange a suitable and mutually agreed upon schedule in which teachers can complete all readings, exercises, and activities specified in the module.

INQUIRY

INQUIRY offers a knowledge base for understanding the nature of a stewardship approach to energy-conserving resource utilization. Activities included here assess the energy-intensive nature of individual lifestyles. Also included are energy-conserving strategies.

INQUIRY

The purpose of this INQUIRY is to present you with text, reading resources, and activities that will develop your understanding of the environmental issue of ENERGY-CONSERVING RESOURCE UTILIZATION. This knowledge will, in turn, help prepare you for (1) making informed personal decisions as a citizen and (2) developing comprehensive curricula for teaching students about this and other environmental issues.

After completing the INQUIRY you will:

(A) Understand energy resource utilization as one of our "problems of success."

(B) Understand the stewardship approach to resource utilization.

(C) Understand the natural systems role in energy-conserving resource utilization.

(D) Develop skills in assessing and comparing various energy-conserving measures.

This INQUIRY examines energy-conserving resource utilization from a stewardship worldview. Complete all INQUIRY activities (readings, discussions, exercises); work together to alleviate any difficulties encountered in these activities; "keep things moving" on schedule; and draw out each other's personal experiences where appropriate.

Specific things to keep in mind:

1. Estimated time to complete the INQUIRY is 36-40 hours.

2. Select a location or room for teacher learning activities which is reasonably quiet and free from distractions and intrusions (and from the possibility of disturbing or intruding on others). For example, avoid classrooms, teacher lounges/rooms or libraries during regular school hours. These same areas after school would probably be useful.

3. Resources needed will include access to a photocopy machine, additional paper, magic markers, crayons or pens (for the Cognitive Map exercise); also, cardboard boxes or styrofoam for 3-dimensional models (optional).

4. Plan a teacher training schedule that will accomodate the completion of all learning activities within the time specified in #1 above. Once teachers agree upon a workable schedule, adhere to it by trying to complete the activities for each section within the allocated time--each section requires about 5-6 hours. If it appears that for a given section of the INQUIRY you are going to run over the allocated time, you can:

   - Reschedule all subsequent section activities to accomodate completing the present section; or
   - Cut off the activity(ies) and move on to the next section.

5. Locate and collect the required reading and material resources specified in the module before the learning sessions begin. This will prevent you and the other teachers from having to spend your "learning" time doing so--unless, of course, the module specifically recommends such information gathering as a useful learning activity.

6. Make certain there are sufficient duplicate copies of the readings so no one is waiting for others to finish.

   Some suggestions for reducing the amount of reading time required are:

   - Make at least one copy of all required readings and have teachers share them; or
   - Make copies of more lengthy readings only and have teachers share these; or
   - Divide up the readings and have individual or pairs of teachers summarize these for the other team members; or
   - Any combination of the above which enables all teachers to complete the required readings in a reasonable amount of time.

7. All or most of the readings can be completed by teachers on their own time in order to free up the meeting times for group discussions and other team learning activities--it makes little sense to waste these occasions on reading sessions. Individual teachers can also take responsibility for leading discussions devoted to specific reading assignments or information gathering activities. Remember to select only the most salient points, concepts, principles or ideas from your readings to present to the group.

8. Some teachers may consistently want to do one type of reading (i.e., science oriented or values oriented). Encourage teachers to do a variety of readings. Try to keep all team members involved as active participants.

9. If members of the learning team are new to one another, you are encouraged to "break the ice" with each other by discussing what personal feelings, thoughts, or ideas you have about the notions of environmental education, ecology, or energy. Perhaps some teachers will have past experiences or anecdotes. This lightens up the beginning of the learning sessions, and gives your group the chance to get their values, beliefs, and attitudes into the open, to "see where everyone is coming from."

10. At the beginning of each section, have a brief overview discussion of what the section contains.

11. You are encouraged to discuss terms and concepts in order to reach a group consensus on their definitions and meanings before proceeding to the next section.

12. Some teachers may find it helpful to glance through the entire INQUIRY before beginning. For others this is not meaningful. But everyone should be familiar with the basic contents of the module (see Table of Contents and Section introductions) and the schedule for completing the sections.

13. Some of the exercises will give teachers ideas about creating materials for their students. This will be helpful in the APPLICATION, but should not be a focus of any discussion in the INQUIRY or INTEGRATION. You are encouraged to make notes for later use.

14. Answers to activity questions can be found in the Appendix, pp. 223-267 Please do not look through these until each activity is completed.

The Module's Goals and Objectives Chart follows. Only those goals relevant to information presented in the INQUIRY are highlighted.

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II. To facilitate teachers' developing cl
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2. Understand how some energy "experts" would map the energy conservation territory.

a. Understand the events and technological developments that have given rise to our high-energy society.

b. Be able to characterize some selected "expert" opinions on the nature of the energy resource utilization problem.

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Develop teachers' understanding of the stewardship approach to resource utilization.

3. Understand how attitudes and values contribute to resource utilization policies and practices.

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l. Recognize potential areas for conservation at the individual household level.

m. Be able to characterize some "new" economic models.

n. Understand some of the legal and political impediments to implementing an energy-conserving resource utilization policy.

E

Apply energy-conserving criteria to individual lifestyle decisions.

9. Apply the knowledge base acquired in the inquiry toward the assessment of a proposed conservation strategy and the recommendation of specific energy-conserving measures for a community.

o. Apply critical skills for the holistic evaluation of an energy conservation strategy.

p. Devise an aggregate-level energy conservation plan that includes potential barriers to implementation.

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10. Be familiar with the basic characteristics of an environmental problem or issue.

11. Plan instructional activities for students on Energy-Conserving Resource Utilization by applying a set of guideline criteria.

q. List major topics, concepts, principles and processes associated with an environmental problem and display them in a contextual map.

r. Complete a checklist for planning environmental instructional units or lessons.

INQUIRY SECTION 1

INQUIRY SECTIONS 2 & 3

INQUIRY SECTIONS 4 & 5

INQUIRY SECTION 6

INTEGRATION SECTION

APPLICATION SECTION

Our Western industrial society has been striving for peak performance and increased yield with no policy for balanced and regulated growth. The result has become today's crisis situation, and a challenge to long-term policy makers as well as individual decision-makers.

Ironically, many of our contemporary social problems have occurred as a result, not of our failures, but of the successful realization or fulfillment of our earlier goals. The following table* illustrates some of the "problems of our successes."

"Successes" of the Technological Era	Resulting Problems of Being "Too Successful"
Prolonging the life span	Overpopulation; problems of the aged
Weapons for national defense	Hazard of mass destruction through nuclear and biological weapons
Machine replacement of manual and routine labor	Exacerbated unemployment, urbanization
Advances in communication and transportation	Increasing air, noise, land, pollution; information overload; "shrinking world'; vulnerability of a complex society to breakdown (natural or deliberate)
Efficient production systems	Dehumanization of evaluative criteria in the world of work
Growth in the power of systematized knowledge	Threats to privacy and freedoms (e.g., surveillance technology, "bioengineering"); knowledge barrier to underclass
Affluence	Increased per capita energy and goods consumption, leading to pollution and resource depletion
Satisfaction of basic needs; ascendance up the "need-level hierarchy	Worldwide revolutions of "rising expectations"; rebellion against meaningless work.

*Adapted from W. W. Harman's "Selected Successes and Associated Problems of the Technological/Industrial Era" in CHANGING IMAGES OF MAN, Stanford Research Institute, May 1974.

As the number and severity of our societal problems increases, so does the pressure to approach them with a system and future-orientation. To structure such an approach to societal level problems, requires a prespective that views the whole totality of interactions between the systems of humanity and the systems of nature. With such a perspective at the conceptual level our multidimensional problems become more manageable and we can examine specific areas of concern without losing sight of the larger context.

This Introduction focuses on the problem area of conservation of our energy resources. The term "energy conservation" describes a broad policy-making position from which a plethora of energy-conserving measures and strategies have been generated. Our potential energy savings (the main concern in the energy conservation literature) can be described in a variety of ways such as: percentages related to the categories of usage, resources needed to supply these demands, or composite "attention getting" generalizations such as: "In 1975, Americans wasted more fossil fuel than was used by two-thirds of the world's population."[1]

The energy-conserving measures and strategies advocated to achieve potential savings consequently range in magnitude from tips on "How to Use Your Swimming Pool More Efficiently" to the use of an industrial incinerator which turns waste paper and wood into most of the energy needed to heat and cool an assembly plant,[2] and on mini-models of world energy flows. The great number of energy-conserving

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[1] Hayes, Dennis, "Energy: The Case for Conservation," Worldwatch Paper 4, Worldwatch Institute, Washington, D.C., 1976.

[2] Wall Street Journal, September 22, 1977.

measures has caused confusion because they are usually presented without any indication of their relative importance. At the individual level, for example, there are many energy-saving tips. But for those measures with the greatest overall potential for saving energy there is very little information.

What is needed is a broad conceptual schema to help us understand the whole territory of energy conservation. A schema broad enough, in fact, to integrate such specialized, discipline-bound perspectives as the economics of energy conservation[3], the technical basis of energy conservation[4], a scientific analysis of energy conservation[5] as well as a psychological approach to energy-conserving attitudes and behavior.

This larger "systemic" view of the essential concepts and relationships involved in energy conservation will enable us to understand which energy-conserving measures make the most sense in terms of potential energy savings, and what the "consequences" could be of adopting certain other energy-conserving measures. For example, what are "the problems of success" associated with everyone insulating their houses, or retrofitting their homes with solar equipment?

In order to evaluate the long-term and far-reaching effects of such conservation measures, it is necessary to have on overview of the whole territory. Without such a dynamic full-scale conceptuali-

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[3]Frank, Helmut J.; and Schanz, Jr., John J. The Economics of the Energy Problem, Joint Council on Economic Education, New York, 1975.

[4]"A Technical Basis for Energy Conservation," Technology Review, Feb. 1974, 15-23.

[5]Schipper, Lee, "Energy Conservation: Its Nature, Hidden Benefits and Hidden Barriers," Energy Communications, Vol. 2, No. 4, 1976.

zation, the specifics (in this case, the many energy conservation measures) merely become static rules and formulas for us to adopt. Without the broader understanding, we are, in fact, at the mercy of the experts and specialists.

SECTION 1

RESOURCES

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SECTION 1

ENERGY CONSERVATION: DIMENSIONS OF THE PROBLEM

Upon completing this section you will:

(a) Understand the events and technological developments that have given rise to our high-energy society.

(b) Be able to characterize some selected "expert" opinions on the nature of the energy resource utilization problem.

If we apply the "problems of success" approcah described earlier to the specific problem of this country's current energy dilemma, we can see that many of the accomplishments associated with the American Dream have been realized. At the same time problems are also appearing and increasing in exact proportion to our success.[1] The energy problem in fact represents a vast pyramid of interrelated second and third order "problems of success" such as the following example:

> Our modes of transportation have developed to such a degree that they now provide us with a great deal of personal mobility, convenience and corresponding employment and investment opportunities.
>
> However, some of the associated problems are an increase in pollution, fossil fuel utilization, accidents, and reliance on the automobile and the trucking industry. Solutions to the increasing pollution in the form of pollution control equipment, for example, have generated another layer of problems associated with a decrease in fuel efficiency and the longevity of auto engines, and an increase in maintenance problems and new pollutants.

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[1] See the INQUIRY Introduction for a list of some of our problems of success.

a. Historical Perspective

What kind of historical path have we followed to bring us to our current situation where our problems seem to increase in exact proportion to our solutions? There are several historical accounts available, which offer the reader a broad overview of mankind's energy history and some of the key technological developments that have helped shape our present high-energy society. Such an historical perspective is a useful tool for gaining insight into viable energy alternatives for the future.

ACTIVITY

FACILITATING NOTES

Activity I: Historical Perspective

(1) Every teacher should do two of the readings: one from Steinhart or Clark and one from Energy and Power or Technology Review.

(2) The questions on p. 4 can be dealt with briefly. This section is part of an orientation to the problems--it is not an in-depth analysis.

OBJECTIVE: (a) To understand the events and technological developments that have given rise to our high-energy society.

READINGS: Clark, Wilson. Energy for Survival: The Alternative to Extinction, 1974, pp. 1-8; 24-57.

Starr, Chauncey. "Energy and Power" in Energy and Power, a Scientific American Book, pp. 3-8. (See Energy Consumption chart, p. 5.)

Hottel, Hoyt C.; and Howard, Jack B. "An Agenda for Energy," Technology Review, 1972, 38-48. (See Energy Sources and Consumption chart, p. 39.)

Steinhart, Carol E.; and Steinhart, John S. Energy: Sources, Use, and Role in Human Affairs, 1974, pp. 33-46.

TO DO:

1. List the primary source of energy for mankind throughout history.

2. List some key "tools" or machines that have affected energy supply and demand.

3. What are some characteristics of a high-energy society?

4. What is the "vicious cycle" of technology development and lifestyle change? (For example, consider the impact of the steam engine or automobile on lifestyle habits and subsequent energy demands.) Give an example.

5. What is the traditional American ethic of resource utilization?

6. What are some high-energy lifestyle needs associated with the following:

- Agriculture (food production)

- Transportation

Communication

Shelter

b. The "Experts"

Examining the past in terms of energy use can help us to understand the consequences of our "successes." It can also help us deal with the wide variety of "expert opinions" put forth by every conceivable societal sector for the purpose of defining the energy issues and offering their vision of the future that must be subscribed to without delay.

Three such "expert opinions" are presented here as "Position Profiles." They were selected from a great number of energy policy statements as being representative of three different "group" approaches to energy decision-making and policy formation.

A short reading by the advocates for each position will help to summarize their views on certain key issues, among which are the questions of energy supply, energy conservation, lifestyle implications, the role of government, and environmental concerns.

ACTIVITY

FACILITATING NOTES

Activity II: The "Experts"

(1) Two of the readings--Mobil Corporation and Georgia Conservancy--may not be readily available. Substitutions can be made without changing the structure of the exercise. Selections should be made to represent somewhat extreme positions. For example, a different oil company statement or a public utility position could be substituted for the Georgia Conservancy.

(2) Teachers will recognize these as extremely different points of view. They may be disturbed by the lack of supporting date. The point of the exercise is to recognize the differences, not to validate any one of them. Again, it is best not to spend too much time discussing these points of view--teachers will be able to do this later in the module.

OBJECTIVE: (b)	Be able to characterize some selected "expert" opinions on the nature of the energy resource utilization problem.

TO DO:

1. Each group member completes one "position profile" reading, answers the discussion questions and fills in the section of the matrix that corresponds to his or her "expert."

2. Members characterize the "expert position" they have reviewed for the rest of the group. (Use Questions and Matrix.)

3. Group compares and contrasts position profiles as reflected in completed matrix.

POSITION PROFILE: 1

"As a way of cutting energy-related problems down to manageable size, the Project has given special attention to the possibilities for saving energy. We believe that the scope of potential energy savings and the benefits of slower energy growth have not yet received their just due in the national energy debate. In this book we hope to demonstrate that slower energy growth than we have recently experienced can work without undermining our standard of living, and can also exert a powerful positive influence on environmental and other problems closely intertwined with energy."

Quotation from:
A Time to Choose: America's Energy Future

THE PROJECT: The Energy Policy Project was supported by the Ford Foundation. The Project produced a final report in 1974 based on the findings of a two year inquiry by staff and consultants representing a wide range of disciplines.

The report summarizes the Project's conclusions and recommendations, offers three "energy futures" scenarios, and presents comments by the Project's Advisory Board.

READING: A Time to Choose: America's Energy Future, Final Report by the Energy Policy Project of the Ford Foundation, Cambridge, Mass.: Ballinger Publ. Co., 1974.

Chapter One: Introducing Energy Policy, pp. 1-18.

Chapter Thirteen: Conclusions and Recommendations, pp. 325-343.

The following readings include detailed descriptions of the three alternate energy futures, or scenarios, that are briefly summarized below:

Chapter Two: The Historical Growth Scenario, pp. 19-44.
Chapter Three: The Technical Fix Scenario, pp. 45-80.
Chapter Four: A Zero Energy Growth Scenario, pp. 81-112.

TO DO: 1. Compare the three scenarios excerpted below in terms of energy supply, conservation, and government role.

HISTORICAL GROWTH	TECHNICAL FIX	ZERO ENERGY GROWTH
Assumes that energy use in the United States would continue to grow to the end of the century. It assumes that no deliberate effort would be made to alter our habitual patterns of energy use. Instead, it assumes that a vigorous national effort would be directed toward enlarging energy supply to keep up with rising demand.	Reflects a conscious national effort to use energy more efficiently through engineering know-how--that is, by putting to use the practical, economical, energy-saving technology that is either available now or soon will be. The effect on the way people live and work would be quite moderate.	Would not require austerity, nor would it preclude economic growth. It includes all the energy-saving devices of Technical Fix, plus extra emphasis on efficiency. Its main difference lies in a small but distinct redirection of economic growth, away from energy-intensive industries toward economic activities that require less energy. Compared with the other energy futures, a ZEG future would have less emphasis on making things and more on offering services.
It is possible, but it would not be easy to fuel the Historical Growth rate. It would mean aggressive development of all available energy sources--oil and gas onshore and offshore, coal, shale, nuclear power. Increased reliance on imported oil could somewhat relieve the pressure on domestic energy sources. In this scenario there would be little scope to pick and choose among sources of supply. No matter how we juggle the mix of sources, coal and nuclear power would have to be the mainstays of energy supply by the year 2000.	Supply options are more flexible in this scenario. The slower growth in energy consumption permits more flexibility and a more relaxed pace of development. The nation could halt growth in at least one of the major domestic sources of energy and still demand less from other supply sources than Historical Growth requires.	ZEG would allow still more choice in supply from conventional sources. After 1985 this scenario could also permit use of cleaner, renewable, but smaller scale energy sources such as windpower, rooftop solar power, and recycled waste to meet a larger share of the total energy demand. Still, it should be remembered that even in this scenario the national energy appetite would be very large.

ACTIVITY II (CONT'D.)

	HISTORICAL GROWTH	TECHNICAL FIX	ZERO ENERGY GROWTH
ENERGY SUPPLY FORECAST			
ROLE OF CONSERVATION IN THE ENERGY FUTURE			
GOVERNMENT ROLE IN ENERGY POLICY			

ACTIVITY II (CONT'D.)

2. Based on Chapters 1 and 13 of A Time to Choose summarize briefly the project's position with respect to the following:

	FORD FOUNDATION PROJECT
1. Energy Supply: Fossil Fuels	
2. Energy Growth:	
• Alternate Energy	
• Hard Technology Sources	
3. Role of Energy Conservation	
4. Need for a "Transition Strategy"	
5. Government Role	
6. Environment Impact	
7. Lifestyle Implications	

POSITION PROFILE: 2

The real challenge: Increasing energy supply

Here are the real issues America must face in the debate over energy:

1. There really is no long-term shortage of energy. The problem centers on the deliverability of domestic energy.

2. Deliverability is hampered by impediments that government has placed in the way of getting energy to you, the consumer.

3. The adverse results that will flow from the non-development of domestic energy are far worse than the adverse consequences of development.

4. Some energy planners would aggravate the artificial shortages in order to increase government regulation over the way Americans exercise their traditional freedom of choice.

We believe that when the American people understand these issues, the nation will be much better equipped to hammer out the national energy policy that's so badly needed and so long overdue.

Quotation from:

The Real Challenge, Increasing Energy Supply

THE COMPANY: In 1977 the Mobil Corporation published a series of "messages" on energy that appeared in several leading newspapers across the nation. The above quote is the summary statement from the first message.

READING: The Real Challenge: Increasing Energy Supply, reprint of 10 energy messages available from Mobil Corporation, 150 East 42nd St., New York, N. Y., 10017, 11 pages.

TO DO:

1. Based on the reading, answer the following questions:

   a. What are some of the "impediments" to deliverability? What societal sectors are responsible for them?

   b. What kinds of control on coal mining does this position advocate?

   c. What role do alternative energy sources play in the Mobil strategy?

2. Characterize the Mobil position in terms of the following:

	MOBIL CORPORATION
1. Energy Supply: Fossil Fuels 2. Energy Growth: a. Alternative Energy Sources b. Hard Technology Sources 3. Role of Energy Conservation 4. Government Role 5. Environmental Impact 6. Lifestyle Implications	

POSITION PROFILE: 3

"It is apparent there are two mutually exclusive energy paths before the nation. One option is based upon continued drift down the path of 'hard'technology. It is fraught with technical risks and with economic and social uncertainties. The second option, which begins with a national commitment to energy conservation, represents a more cautious, sustainable approach. But while the choice of either tends to preclude the other, only the hard path is irreversible.

We recommend the development of a comprehensive energy policy that commits the nation to energy conservation and to a gradual, planned transition to renewable energy sources."

Quotation from:
The Wolfcreek Statement: Toward a Sustainable Energy Society

THE PROJECT: On October 22-24, 1976, the Georgia Conservancy group of scholars and environmentalists met in the North Georgia Mountains at Wolfcreek Wilderness to discuss the nation's energy future.

The Wolfcreek Statement is the product of that meeting.

READING: The Wolfcreek Statement: Toward a Sustainable Energy Society, reprinted 1977 by the Georgia Conservancy, 3110 Maple Dr., Suite 407, Atlanta, Georgia, 30305, 13 pages.

TO DO:

1. Based on the reading, answer the following questions:

   a. What does this statement cite as the physical and economic realities and the environmental and socio-political risks of the "conventional energy approach?"

   b. What are some of the ways this Project recommends saving energy?

2. Characterize the Georgia Conservancy's position in terms of the following:

	GEORGIA CONSERVANCY
1. Energy Supply: Fossil Fuels 2. Energy Growth: • Alternative Energy Sources • Hard Technology Sources 3. Role of Energy Conservation 4. Government Role 5. Environmental Impact 6. Lifestyle Implications	

ACTIVITY II (CONT'D.)

SUMMARY EXERCISE

1. As a group, use your individual position profiles (as previously charted) to compare and contrast ALL THREE "expert" positions in the chart below.

	FORD FOUNDATION PROJECT	MOBIL CORPORATION	GEORGIA CONSERVANCY
1. Energy Supply: Fossil Fuels			
2. Energy Growth: • Alternative Energy Sources • Hard Technology Sources			
3. Role of Energy Conservation			
4. Government Role			
5. Environmental Impact			
6. Lifestyle Implications			

SECTION 2

RESOURCES

Bender, Tom, Sharing Smaller Pies, Portland, Oregon: RAIN, 1975.

Berry, Wendell, "Exploitation and Nurture," CoEvolution Quarterly, Spring, 1977.

Blackstone, William T., (ed.), Philosophy and Environmental Crisis, Athens, Ga.: University of Georgia Press, 1974.

Hardin, Garrett, and Baden, John, Managing the Commons, San Francisco, W.H. Freeman and Co., 1977.

Illich, Ivan, Energy and Equity, New York: Harper and Row, Publ., 1974.

Kahn, Herman, et al. The Next Two Hundred Years, New York: William Morrow & Co., Inc., 1976.

Satin, Mark, New Age Politics: Healing Self and Society, Vancouver: Whitecap Books, 1978.

Schachter, Oscar, Sharing the World's Resources, New York, Columbia University Press, 1977.

Stone, Christopher D., Should Trees Have Standing? Toward Legal Rights for Natural Objects, Los Altos, CA, William Kaufmann, Inc., 1974.

SECTION 2

WHAT IS A STEWARDSHIP WORLDVIEW?

Upon completing this section you will:

(d) Understand the attitudes and values that contribute to the evolution of a Stewardship Worldview.

This section presents a worldview consistent with the attitudes and values inherent in a conservation approach to resource utilization. This worldview reflects a "Kindly Use" attitude toward our planet's resources and requires individuals to take responsibility for their resource-related activities. It considers the finite nature of our resources and projects an ideal of equity to ensure individual access to primary means of production.

a. Definition of Worldview

A worldview is a set of beliefs concerning the basic nature of man and the universe. The key word in this definition is beliefs. Beliefs, unlike facts, are neither verifiable nor demonstrable. They are based on assumptions and hopes: what we assume to be true and what we hope will become true.

This set of beliefs is a value-indicator; it plays a major role in the process of forming values. It influences in direct and subtle ways how we perceive and how we judge our experiences. Our worldview supplies the underlying framework that molds our attitudes and shapes our behavior.

A societal or aggregate worldview reflects the cultural experiences that were part of our early socialization. It often becomes increasingly difficult, as time passes, to reconsider or reorient our beliefs and incorporate new or additional areas of experience. Our worldview with its set of beliefs becomes like the light and air in a room--it is so pervading and omnipresent that it sinks from consciousness until recalled for us by some sudden change. What began as assumptions can, as they become more natural and unquestioned, take on the aura of the absolute.

Worldviews, though largely invisible, nonetheless greatly influence our choice of policies, the kinds of educational systems we design, our approach to resource

utilization and distribution of material goods, our priorities with respect to human needs, and so on.

Worldviews are constantly in the process of evolving; however, it is possible, at the collective level, to define essential characteristics of past and present worldviews and to consider their orientation with respect to certain elements of the human environment.[1]

[1] For comparative descriptions of worldview perspectives defined in terms of elements such as technology and capital, resources, current growth and quality of life, see Herman Kahn, et al, The Next 200 Years, West Caldwell, N.J.: William Morrow & Co., Inc., 1976, and Jim Benson, "Energy and Reality: Three Versions," RAIN Vol. IV, No. 3, December, 1977, pp. 18-21.

b. Characterization of a "Stewardship Worldview"

Collective attitudes and beliefs do change over time. And, while the prevalent worldview is changing, the accompanying period of transition usually generates some conflict.

A focal point in today's evolving worldview is the effects of our attitudes and beliefs on both the human and natural systems. Certain of our assumptions about growth, technology, natural resources and the quality of life have been challenged or proven wrong.

> We have plunged headlong for more than half a century into development of a technological direction unprecedented on this planet, and are now finding that its direction is unsustainable, its effects undesirable, and its replacement necessary if we are to ensure the soundness, stability, and permanence of our society, our individual freedom and opportunity for personal growth, and the overall health and well-being of our society.[2]

The worldview that is currently evolving will have to accommodate new values and new concerns if it is to enhance our quality of life while maintaining a harmonious relationship with the biophysical systems that support our existence.

This new worldview, which we call a Stewardship Worldview, recognizes the need to re-evaluate our present dreams and the unrealistic demands we make on our energy resources and life support systems to fulfill those dreams. This Stewardship Worldview is characterized here according to its beliefs about:

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[2]Bender, Tom, Sharing Smaller Pies, Portland, Oregon: RAIN, 1975, p. 5.

- natural systems
- the relationship of humanity and nature
- human relationships

(1) Beliefs about Natural Systems

> "Though human society can develop in many substantial ways, by using up its capital stock of non-renewable resources, it must ultimately come to terms with and live in a sustainable equilibrium with the biosphere."[3]

The stewardship view of natural systems is based on the notion that the resources of the world are finite. Even though some of the mineral resources are present in vast quantities, our rate of consumption exceeds their regenerating capability. Thus, the Stewardship Worldview recognizes that a rational and conserving approach to the utilization of our energy and environmental resources is necessary to ensure a high quality of life for this and subsequent generations.

Consequently, the health or equilibrium of natural systems becomes a primary criterion of the Stewardship Worldview's orientation toward resource utilization policies and practices. Ultimately, it is the condition of our natural systems which provides the real physical base for the survival and welfare of humankind.

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[3]Science Council Committee on the Implication of a Conserver Society, "Toward a Conserver Society: A Statement of Concern," Science Forum Vol. 9, No. 3, June, 1976.

(2) Relationship of Humanity and Nature

The notion of "stewardship" best describes humanity's relationship with natural systems. Stewardship, as defined in Webster's terminology, is "the individual's responsibility to manage his life and property with proper regard to the rights of others."[4] And, we would add, to the rights of natural systems.[5]

There are other terms and concepts associated with the notion of stewardship which further explicate its dimensions; these are illustrated by the following excerpts from Wendell Berry's article "Exploitation and Nurture."[6] Berry outlines the primary concerns of stewardship in terms of:

NURTURE — "the care of the earth is our most ancient and most worthy, and, after all, our most pleasing responsibility. To cherish what remains of it, and to foster its renewal, is our only legitimate hope."

PROTECTION — "In all of these systems [human and natural] a fundamental principle must be the protection of the source: the seed, the food species, the soil, the breeding stock, the old and the wise, the keepers of memories, the records."

KINDLY USE — "Understanding, imagining, living out the possibility of 'kindly use' can dissolve the boundaries that divide people from the land and its care, which together are the source of human life."

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[4]Webster's New Collegiate Dictionary, G. M. Merriam Company, Springfield, Massachusetts, 1977 (p. 1142).

[5]For an essay proposing that natural objects such as trees, mountains, rivers and lakes--like corporations--have legal rights see Christopher D. Stone, Should Trees Have Standing? Toward Legal Rights for Natural Objects, William Kaufmann, Inc., Los Altos, CA, 1974.

[6]Berry, Wendell, "Exploitation and Nurture," CoEvolution Quarterly, Spring, 1977, pp. 57-71.

INDIVIDUAL RESPONSIBILITY

"Kindly use depends on intimate knowledge, the most sensitive responsibleness and responsibility."

"No matter how general may be a person's attitude toward the world, his impact on it must become specific and tangible at some point."

"FUTURE IS NOW"

"It is no doubt impossible to live without thought of the future; hope and vision can live nowhere else. But the only possible guarantee of the future is responsible behavior in the present."

(3) Human Relationships

EQUITY

The Stewardship Worldview proposes that humankind be guided by a principle of equity which as we will see, has important implications in different realms of human interactions. Equity, as it applies to man's relationships with this finite "pie" of resources, is an elusive concept to explicate. The most common conceptions of equity, relative to discussions of energy and environmental issues, focus on equitable distribution of resources and social versus environmental quality.

Discussions on resources usually center on the inequitable distribution of resources, goods and services between the developed and the less developed nations or between urban and rural areas. Discussions on inequitable distribution often center on the less affluent whose job earning rights are being endangered by machinery and automation and by the detrimental impacts resulting from over-exploited resources.

COST DISTRIBUTION

In terms of the Stewardship Worldview, equity, as it applies to resource distribution, is also concerned with an equitable distribution of external costs involved in resource utilization. For example, currently, those who are responsible for polluting our waterways, are rarely the ones who pay for the corrective actions. The costs are usually "distributed" to the taxpayers. Distributing external costs such as these to those responsible would be a more equitable practice.

ACCESS

The notion of equity also guarantees individual and community access both to primary resources and to the goods and services produced from them. It further ensures access to learning opportunities as a means to become a producer of goods and services. Whether this be access to information, job training opportunities or formal education, it is a means to developing opportunities for meaningful work in our society--work that is more than an income. It is, rather, a means of self-expression and a way to establish family and community connections.

In Sharing Smaller Pies, Tom Bender outlines some means for achieving equity:[7]

[7] Bender, Tom, Sharing Smaller Pies, p. 17.

"Equity is not only possible, but is necessary to restore choices of where and how one lives. It is necessary to restore alternatives to our unaffordably costly urban systems. It can be achieved through introduction of appropriate technology; through control of organization size; by equalizing income and available wealth; by establishing equal access to learning opportunities, health care, justice, and other services; and by assuring everyone the opportunity for meaningful work. It can be achieved by returning to individuals the responsibility and control of their lives, surroundings, and social, economic, and political systems; by ensuring freedom to not consume or depend upon any systems ... than one's own abilities; and by encouraging the ownership of the tools of production by the people who do the work, thus increasing the chances of developing a balanced, affluent, and stable society."

In the next section we will look at some of the "appropriate technologies" and lifestyle practices that seek to implement this notion of equity as well as some other "new values" associated with the Stewardship Worldview.

ACTIVITY

FACILITATING NOTES

Activity I: Definition of Worldview

(1) Before doing Activity I make certain there is common understanding as to the definition of worldview.

(2) It is recommended to do the exercise as a group. This will result in a more complete profile of Group Five, reinforce each person's understanding of worldview components in general and expose some indivudial biases.

(3) Consider as a group the questions under #3.

(4) Teachers will probably enjoy creating this profile, but should move along, keeping in mind that more substantive sections follow.

OBJECTIVE: (c) Be able to characterize some past and present worldviews.

TO DO: 1. Using the date provided* in the profiles of Groups One to Four (see following pages) consider the following and fill in the chart below:

a. How many motor vehicles were in use?

b. What was the power input in horsepower for these time periods?

c. What were the "primary concerns" for each worldview, the issues of national importance at the time?

d. What were some means of energy expenditure in terms of transportation and recreation for each group?

	I 1896	II 1924	III 1935	IV 1953
U. S. Population	66,970,000	114,113,000	133,402,000	159,636,000
GNP	$13.6 Bill.	87.6 Bill.	125.8 Bill.	365.4 Bill.
Motor Vehicles				
Televisions	0	0	0	20,400,000
Power Input**				
National Concerns				
Transportation, Recreation				

*Reprinted with permission from The Children of Change, by Don Fabun, Glencoe Press/Macmillan Company, Beverly Hills, 1969.

**1HP = 0.7455 Kilowatt

2. Create a profile of Group Five--people born in 1965.

   a. What were their Inputs?
   List some significant persons or events in the following areas:

   - Media (Films, TV, Music)
   - Politics
   - Sports
   - Technology
   - Heroes
   - "New" Religions

   b. What were their Imprints?
   (List events of 1965-1972 which they would have been exposed to as very young children.)

3. Based on this profile consider the following questions:

   a. What problems will Group Five face in regard to resource utilization?

   b. How might their dreams, aspirations and lifestyles differ from those of Group Four?

GROUP ONE

BORN, CIRCA 1896

GROUP 1

Of concern to *them*, thus the subjects for imprinting Group II children (born 1914 — ages 1 to 7 through 1921): The Mexican Revolution with Pancho Villa. Gen. Pershing in pursuit; Amundsen reached North Pole. Scott reached South Pole. First transcontinental airplane flight. S.S. *Titanic* sank. Chinese revolution under Sun Yat-sen overthrew Manchu dynasty. Income tax authorized. Panama canal opened. World War I. The I.W.W. Prohibition law passed. The Russian Revolution began. An influenza epidemic killed 20 million people, including 548,000 Americans. In the years while their children were growing up they talked much about the war, America's role in it, and their own parts. They did this while playing "500" and Mah Jong while the kids (Group II) "slept" on the daybeds and drank it all in.

Born, circa 1896. Now in their 70's. They serve, if they are not retired, as chairman of the board of the world's largest corporations; as members of the Board of Regents of the largest universities; as heads of the most influential committees in Congress and the Senate; as publishers and owners of the mass media. These are the tribal elders, sitting in our society's long house. They may not be influential much longer, but while they are, they create the stage setting in which The Movement does its thing.

BY THE TIME THEY WERE 18:

The stars in their galaxy were Sara Bernhardt, Florenz Ziegfeld and Rudolph Valentino. The big pictures were Ben Hur (1907, in 16 scenes), Quo Vadis (1913) and Birth of a Nation (1914). The first time they heard sound with a motion picture was in Don Juan (1926). The cartoons they read in their newspapers were Little Nemo, Old Doc Yak, and Col. Heeza Liar. Popular cartoons with more polished techniques were The Katzenjammer Kids, Krazy Kat and Mutt and Jeff.

WHAT KIND OF A WORLD WAS IT? (1896)

U.S. population: 66,970,000. Gross national product: $13.6 billion. Price index: 46 (1929—100). No. of motor vehicles: Nil. No. of telephones: 404,000—5.7 per 1,000 population. No. of radio sets: Nil. No. of television sets: Nil. Productivity per man hour—49.5 (1929—100). Power input—65,043,000 horsepower.

IMPRINTS:

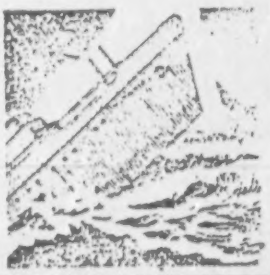
(Age 1 to 7)

God's in his heaven, all's right with the world.

Cleanliness is next to godliness.

Man earns his bread by the sweat of his brow.

Man was born in sin, but can achieve heaven by good works.



God created the world and all that is in it, and this has continued from the beginning of time.

Man, through his rationality can solve all problems; it is only emotion and feeling that get in the way.

The important thing is to find answers; not to ask questions. We already know the answers.

Truth has already been established. It is simply a matter of transmitting it to the young.

We have a mission in the world, and it is to make other people believe and act as we do.

WHAT THEY BELIEVED

There was never any question as to who held authority: the parents did. Old folks knew what was going on. What was going on that was of concern to the parents was the Spanish-American war, the South African (Boer) war, the Filipino war, the Boxer rebellion in China, the Cuban Revolution, and the assassination of President William McKinley. Stirring times; not unlike our own.

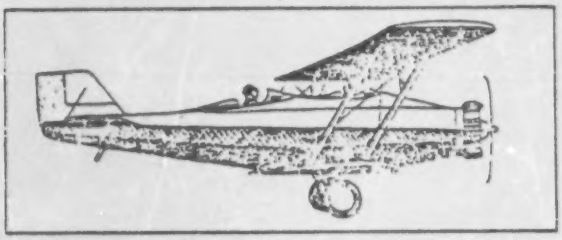
Illustrations by Masami Miyamoto

GROUP TWO

BORN, CIRCA 1914

GROUP 2:

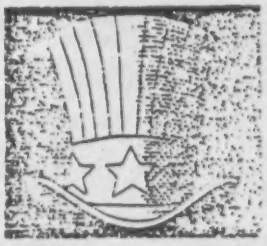
Now in their mid-50's. These are, for the most part, the people who are in charge of industry, business, finance, government, education, the church and the mass media. This is, in short, The Establishment. The Establishment may be defined as people who have the same backgrounds, share the same inputs and imprints, hold pretty much the same views. This generation went through two traumatic episodes: The Depression (they were in their late teens, early 20's then) and World War II (they were still young enough to fight). Both events profoundly influence their decisions today. It is against this age group that The Children of Change have mounted their offensive.



Some other of Group II's inputs: Steinbeck's "The Grapes of Wrath" (1940), whose message, 30 years later, is just coming across. Academy Awards: James Stewart in "The Philadelphia Story"; Ginger Rogers in "Kitty Foyle." Best picture: "Rebecca." The Kentucky Derby winner was Gallahadion; the Heisman Trophy winner was Tom Harmon of Michigan; the Chicago Bears won the N. F. L. championship, and, almost incidentally, Franklin Delano Roosevelt and Wendell Wilkie were the presidential aspirants. Wilkie's slogan of "One World" fell on deaf ears. But Group III would hear it loud and strong.

Group 2's *imprints* largely consisted of the wave of nationalism and pride that followed America's participation in World War I.

Their *inputs* included the automobile (which increased mobility, privacy and sexual freedom), the radio (which broke down provincial restraints on information); most of all The Depression; and some kind of participation in World War II. The "set" of their times was strongly economic (just finding a job and making a living was difficult and increasingly militant).



The *Saturday Evening Post* furnished much of the input for non-intellectuals: "Tugboat Annie," "Tutt & Mr. Tutt," "Alexander Botts and the Earth-worm Tractor Co.," Chief Engineer Glencannon and the *S. S. Inchcliffe Castle*. The net effect was reinforcement of the American mythology. Mom's Apple Pie and cigar-smoking monkeys were visual inputs. In retrospect, an old timey sort of world. It was shattered one morning at Pearl Harbor and for the first time Group II became aware of an Asia that wasn't based on the lyrics of *The Mikado*. The experience was traumatic. Group II never recovered; the "Cold War" was part of the result. Someplace in there, a Bomb went off. It was Group II's bomb.

WHAT KIND OF A WORLD WAS IT? (1924)

U.S. POPULATION: 114,113,000. GROSS NATIONAL PRODUCT: 87.6 billion. PRICE INDEX—99 (1929—100). NO. OF MOTOR VEHICLES—7,612,940. NO. OF TELEPHONES—16,073,000—139.7 per 1000 population. NO. OF FAMILIES OWNING RADIO SETS: 1,250,000. NO. OF FAMILIES OWNING TELEVISION SETS—Nil. PRODUCTIVITY PER MAN-HOUR—91.7 (1929—100). POWER INPUT—459,000,000 horsepower.

WHAT THEY BELIEVED:

Well, among other things, that America had the answers to almost everything. If other people would just listen. This was about to come unraveled in 1939 and 1942, but they had no way of knowing that then. What don't we know now?

The heroes were Wylie Post, Will Rogers, Amelia Earhart, Lou Gehrig, Schoolboy Roe. Everything fiercely patriotic: Fourth of July type parades, chromed helmets flashing in the sun; picnics in the park; flags waving. Another world, another time. Gone now.

GROUP THREE

BORN BETWEEN 1935 AND 1942

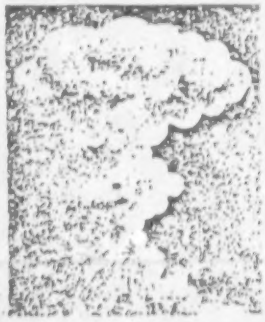
GROUP 3 IMPRINTS —

Their parents were still (in 1935) caught up in the Depression. Largely pre-occupied with jobs, money, acquisition of material objects. Things were getting a little better, largely due to war contracts around the world. Conflicts in Morocco, Ethiopia, Spain, China and in Western Europe created a demand for American goods, particularly iron and oil. The parents (Group II) had by now largely romanticized America's role in World War I. Even so, a strong isolationist feeling persisted; not to get "involved" again. But involvement increased. The parents talked about the loss of Amelia Earhart; sinking of the U.S. gunboat Panay by the Japanese; nationalization of the Mexican oil industry; the world's first surviving quintuplets; the killing of John Dillinger; the New York World's Fair. Parental emphasis was still on thrift and saving. During Group III's early lives, tin foil and aluminum foil, grease and paper were saved. Although the "enemy" did not have any aircraft capable of flying either the Pacific or the Atlantic, children were instructed in air-raid procedures and coastal cities were blacked out.

WHAT KIND OF A WORLD WAS IT? (1935)

U.S. POPULATION: 133,402,000. GROSS NATIONAL PRODUCT: $125.8 billion. PRICE INDEX: 91 (1929-100). NO. OF MOTOR VEHICLES: 34,849,134. NO. OF TELEPHONES: 23,521,000 (175 per 1,000 population). NO. OF FAMILIES OWNING RADIO SETS: 29,300,000. NO. OF FAMILIES OWNING TELEVISION SETS: Nil. PRODUCTIVITY PER MAN-HOUR: 134.6 (1929-100). POWER INPUT, 2,759,018,000 horsepower.

GROUP III was born between 1935 and 1942. Its members joined the 18-to-24 age group in 1953 (in time to participate in the Korean War) or, at the latest, to participate in the American part of the Vietnam War (1961). Today they are 27 to 34 years old. They are in lower or middle management positions in most institutions. World War II and The Depression are only infantile imprints for them. Group III is a war generation: (Spanish-Civil War, Italian-Ethiopian war, Chinese Japanese war, beginnings of World War II, Pearl Harbor, Korean War, Vietnam war). They grew up in the shadow of



The Bomb and the ICBM. And of Sputnik. They find themselves caught at the interface between an old (Group I, Group II) value system and that of the New

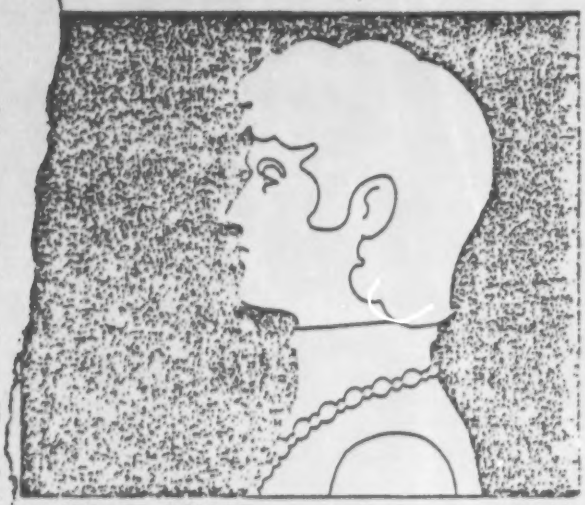
Youth. For the next 20 years, this is the group to watch. In the game that's goin' on, they'll have to choose sides soon.

GROUP III INPUTS.

Radio and Saturday afternoon matinees constituted most of the educational input for this group. Roy Rogers, Gene Autry, Hopalong Cassidy and the Cisco Kid were film heroes. The cowboy image, as created by Hollywood script writers, was very strong. It was reflected in the choice of Gary Cooper in "High Noon" for an Academy award (1953). Television did not significantly influence this group (the first continental broadcast was in 1951). The Korean War and the prospects of military service did. The Bomb, and then the Bigger Bomb, the ICBM's, the Cold War, the McCarthy hearings were all realities for teen-age minds. Comic books formed the basis of the fantasies of many youngsters; the "good-guy," "bad guy" mythology of the parents was reinforced. There was little public questioning of the values of the American society, either in the schools or out of them. The mass movement of the more affluent out of the cities and into the suburbs created little enclaves of people of the same race, same age group, same economic and educational background. Isolation and alienation had begun, and it mostly affected Group III.

GROUP FOUR

BORN BETWEEN 1945 AND 1951

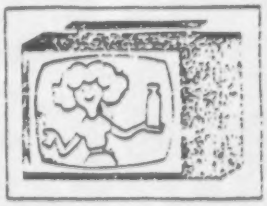


WHAT KIND OF A WORLD WAS IT? (1953)

U.S. POPULATION: 159,636,000. GROSS NATIONAL PRODUCT: $365.4 billion. PRICE INDEX: 170 (1929-100). NO. OF MOTOR VEHICLES: 56,221,089. NO. OF TELEPHONES: 50,373,000 (312.7 per 1,000 pop.). NO. OF FAMILIES OWNING RADIO SETS: 44,800,000. NO. OF FAMILIES OWNING TELEVISION SETS: 20,400,000. PRODUCTIVITY PER MAN-HOUR: 190.9 (1929–100). POWER INPUT: 5,726,886,000 horsepower.

GROUP 4 INPUTS:

This was the first TV generation. TV began transcontinental broadcasting in September, 1951. By the time Group IV was of kindergarten age, there already were 33,269,000 sets in use. The TV set took over the role of babysitter, mother, father and teacher. The mythologies that had earlier been transmitted by parents to children, on radio, and through comic books and school texts, now were reinforced on the TV screen. There was one important difference – in its direct broadcasts of news coverage, and in some of its documentaries – the experience was not "edited."



With minor exceptions this became the first mass medium that "told it like it is." Not always, of course, but often enough to impress young minds. It *was* one world. It was also highly fantasized, through re-runs of old movies; through commercials. But some of it was "real" and it was *now*. What was taught in school appeared to some so irrelevant that they wondered why one attended class at all. Some didn't. Some of the latter set out to change a system TV had made irrelevant.

Their entire experience has been in the Age of the Bomb, television, the war in Vietnam, space satellites, nuclear energy, jet transport, economic affluence, computerized technology, urban dissolution, suburban sprawl, a growing public awareness of poverty and racism; most of all a world order dominated through institutions, by Group II leaders in the form of a military-industrial complex of political and economic forces for which they did not vote and in which they have no voice. The educational system appears to be largely intended to furnish more leaders for "The Establishment." World War I. The Depression. World War II, the Korean War are dim historical memories. Nearly everything they are taught in school appears irrelevant to the world in which they find themselves. When they try to change "The System," they find themselves confronted by "The Establishment." Some of them keep trying. Some of them drop out. Some of them don't care. Because of television, this probably is the best educated, most aware generation in the history of any civilization. It knows it will inherit "The System." The question it asks is whether it wants to.

GROUP 4 IMPRINTS:

Parents and grandparents had survived two World Wars and The Depression. They were enjoying a new affluence brought about largely by the application of a rapidly advancing industrial technology. The family problem was still money but in a different context: not whether there was any, but how best to spend it. Contemporary events that the parents talked about in the presence of children were the signing of the Korean War armistice; the death of Stalin; Mt. Everest climbed; Russia's H-Bomb, ten years ahead of time; the McCarthy hearings; the fall of Dien Bien Phu (although its relevance to the future of the Group IV children in the U.S. was not then apparent). Sputnik I was launched in 1957. Although few saw its significance then, Sputnik was profoundly to influence the American educational system, by turning its emphasis from the humanities to scientific technology. By the time Group IV entered college, this had become an important point.

OTHER GROUP 4 INPUTS:

The transistorized, miniaturized radio took information out of the living room and into the relative privacy of city streets and the interiors of automobiles. Starting in the mid-1950's there was a wave of new inputs. It poured through the interstices of the Group II parents. For most of Group IV it was just another form of entertainment—not unlike Guy Lombardo or Lawrence Welk for their parents. To some, the new sound and the new sight were signals for a revolution. It was a revolution based on electronic technology. It fed on information; songs of protest, non-filtered words and images. And not the type likely to be found in the classroom. The revolution begins here.

ACTIVITY

FACILITATING NOTES

Activity II: Characterization of a Stewardship Worldview

(1) It is important that teachers have an understanding of the word "Stewardship" before doing the readings. It is a concept that forms the basis of all further discussion regarding energy-conserving behavior. Use the dictionary definition if necessary to reinforce the idea of responsibility, the role of guardian or caretaker.

(2) The discussion on pp. 46-47 introduces the underlying premises of a Stewardship Worldview (i.e. finite resources, equity, nurturing). It introduces many new terms which should be briefly discussed prior to doing the readings.

(3) The readings themselves are supportive of a Stewardship Worldview, but the actual characterization of this worldview will come from the teachers' discussion.

(4) The summary which will appear on p. 66 is important. It can be approached in the given format (Key words) or a different type of summary could be generated by the group.

OBJECTIVE: (d) Understand the attitudes and values that contribute to the evolution of a Stewardship Worldview.

TO DO:

1. Each group member completes one of the readings and the questions associated with that reading.

2. Based on this reading each person offers the group a brief characterization of the attitudes and values that contribute to a Stewardship Worldview.

3. The group discusses how a Stewardship Worldview would promote energy-conserving resource utilization.

READING I: Berry, Wendell, "Exploitation and Nurture," CoEvolution Quarterly, Spring, 1977, pp. 57-71.

TO DO:

1. Summarize the characteristics of a "model exploiter" and a "model nurturer" as described by Wendell Berry. Include the standards, goals and attitudes of each.

Model Exploiter	Model Nurturer

2. Why would it be difficult for some conservation-minded citizens to practice a "kindly use" philosophy toward our resources? (p. 62)

3. What are some reasons that wilderness preservation is the ethical backbone of any conservation effort? (p. 63)

READING II: Stone, Christopher D., Should Trees Have Standing? Toward Legal Rights for Natural Objects, 1974, pp. 10-54.

TO DO: 1. Discuss Stone's "serious proposal to give legal rights to 'natural objects' in the environment" in terms of the following:

a. The legal-operationsl aspects: what are some steps toward legislating "kindly use"?

b. The psychic and socio-psychic aspects: how can we value "kindly use"? Consider some implications of conferring rights on the environment in terms of our lifestyle habits and expectations. What are the tradeoffs and the advantages?

2. What are the implications of establishing legal rights for natural objects in terms of the following:

a. "Kindly Use" of resources

b. Energy-conserving lifestyle

c. Individual responsibility

d. Equity

READING III: Bender, Tom, Sharing Smaller Pies, RAIN, 1975, pp. 1-20.

TO DO:

1. What are the "new resource and economic realities" that our lifestyles and values must accommodate? (pp. 1-6)

2. List the "new values" that Bender feels will help us come to "a new understanding of what is desirable for a harmonious and sustainable relationship with the systems that support our lives." Contrast these values with some of our past and present attitudes and values. Discuss the differences between these values with the group.

"NEW VALUES"	PAST & PRESENT VALUES

STEWARDSHIP WORLDVIEW

SUMMARY

Based on the readings and discussion characterize the Stewardship Worldview approach. Include the following notions as well as any other terms or categories you feel are relevant.

a. "Finite Pie"

b. Equity (access and distribution)

c. Nurture

d. "Kindly Use"

e. Use of Tools

f. "Wholeness of Work"

g. Individual Responsibility

h. "Future is Now"

i. Centralization/Decentralization

j. Energy-Conserving Lifestyle

SECTION 3

RESOURCES

Bender, Tom, Sharing Smaller Pies, Portland, Oregon: RAIN Publications, 1975.

Ehrlich, Paul R., Ehrlich, Anne H., and Holdren, John P., Ecoscience: Population, Resources, Environment, San Francisco: W.H. Freeman and Co., 1977.

Elgin, Duane and Mitchell, Arnold, "Voluntary Simplicity", The CoEvolution Quarterly, Summer 1977.

Hayes, Denis, "The Coming Energy Transition" in The Futurist, 9:5, 303-309, October 1977.

Lovins, Amory B., Soft Energy Paths, San Francisco: Friends of the Earth, 1977.

Schumacher, E.F., Small is Beautiful: Economics as if People Mattered, New York: Harper & Row, 1973.

SECTION 3

STRATEGIES FOR ENERGY-CONSERVING RESOURCE UTILIZATION

Upon completing this section you will:

(e) Be able to characterize three sample resource utilization strategies.

This section describes three "adaptive" strategies that seek to implement the tenets of the Stewardship Worldview.

How can the notions of equity and "kindly use" of human and natural resources, which were described earlier, be implemented? This section describes some of the energy conservation resource utilization strategies that are consistent with the stewardship worldview and respond to one of its basic premises: our resource conditions in terms of utilization, supply and storage are changing, and our present "energy utilization plans" are unrealistic in terms of the future we face.

If we accept the fact that our present and future energy requirements cannot be met by continued dependence on our fossil fuel resources, then it becomes obvious that some alternative strategies for resource utilization need to be developed. Additionally, some guidelines are needed to define and encourage energy-conserving practices among consumers. This does not mean energy deprivation or any reduction of comfort in lifestyle; it does mean consuming quantitatively less, expecially in terms of products that are energy-inefficient,[1] and not biodegradable.

These ideas of simplicity and frugal living are not new to this society. Historically, they are grounded in the legendary frugality and self-reliance of the Puritans, in Emerson's plea for "plain living and high thinking", and in the simplicity of western frontier life. Their re-emergence in contemporary society is a response to a very real and urgent societal problem.

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[1] Energy efficiency is the ratio of useful energy output to the total energy input. No energy conversion is 100% efficient; some energy is always wasted. But we can reduce the demand for products with very low efficiencies.

ADAPTIVE STRATEGIES

The strategies presented here are called "adaptive" strategies because they "show or have a capacity for adjustment to environmental conditions."[2] What these adaptive strategies hold in common is the premise that our technology--our tools and techniques--must be "appropriate" both to our lifestyle needs and dreams and to our available energy resources. In terms of a stewardship worldview this means an appropriate technology would encourage individual participation and responsibility and promote energy-conserving and equitable resource practices.

The adaptive strategies cited here--intermediate technology, voluntary simplicity and the "Soft Path"--are all dedicated to making these ideas and values attainable at the individual level as well as at the aggregate level.

The following characterization of an appropriate technology reflects the overall goals of each of these three strategies.[3]

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[2]Webster's New Collegiate Dictionary.

[3]For a set of criteria for appropriate technology see Tom Bender, Sharing Smaller Pies, p. 20.

CHARACTERISTICS OF AN APPROPRIATE TECHNOLOGY[4]	
Ecological	Does not release pollutants or poisons to the environment Protects the existing natural habitat and viability of existing ecosystems Recycles organic nutrients Conserves renewable resources
Energetic	Conserves non-renewable resources; promotes use of renewable energy sources Promotes use of recycled materials Reduces transportation dependence
Economic	Durable, repairable, low cost Promotes small-scale production, local ownership bioregional economy Promotes meaningful work and income; labor and skill intensive
Social/ Political/ Cultural	Enriches human habitat Promotes social flexibility, diversity, self-reliance, community cooperation Understandable and usable at the community level Creates and maintains natural beauty

[4]Adapted from a statement of criteria from the State of California Office of Appropriate Technology.

a. Intermediate Technology

> "Does the idea of intermediate technology mean a return towards more primitive modes of work? Well, yes and no. In the sense of a return to simpler technology, decentralized and non-violent, yes. In the sense of adandonment of sophistication and elegance--by no means. As Schumacher has said: 'We now possess such superlative scientific knowledge and technical ability that we can make things simple again'."[5]

E.F. Schumacher and others have described Intermediate Technology as being somewhere between elaborate machines and primitive tools, between high technology and low technology, "up from the small; down from the large, and totally new, some of all these three."[6]

The work of Schumacher's Intermediate Technology Development Group in England, and of other such groups around the world, aims to inspire and make possible technological self-reliance by instructing individuals and communities on the production of their own goods, services and energy. Schumacher calls his approach "a technology with a human face." He supports a system of production by the masses as opposed to mass production.

PRODUCTION BY THE MASSES

> "I have no doubt that it is possible to give a new direction to technological development, a direction that shall lead it back to the real needs of man, and that also means: to the actual size of man."[7]

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[5] Intermediate Technology Report No. 1. Menlo Park, CA, Winter/Spring 1976, p. 7.

[6] Ibid.

[7] Schumacher, E.F., Small is Beautiful: Economics as if People Mattered, New York: Harper and Row, 1973.

b. Voluntary Simplicity

> "For the past several years the popular press has paid occasional attention to stories of people returning to "the simple life"--of people moving back to the country or making their own bread or building their own solar-heated home, and so on. Beneath this popular image of simple living, there is a major social movement afoot which has the potential of touching the United States and other developed nations to their cores."[8]

The essence of voluntary simplicity is living in a way that is outwardly simple and inwardly rich. This way of life embraces frugality of consumption, a strong sense of environmental urgency, a desire to return to living and working environments which are of a more human scale, and an intention to realize our higher human potential--both psychological and spiritual--in community with others.[9]

HUMAN SCALE

Elgin and Mitchell further describe this adaptive strategy by stating that it is not the following:[10]

- a back-to-nature movement
- a carryover from the counterculture movement of the 1960's
- living in poverty
- a social panacea
- a movement with heart but no skills
- confined to the United States
- a fad

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[8] Elgin, Duane and Mitchell, Arnold, "Voluntary Simplicity (3)" in The CoEvolution Quarterly, Summer, 1977, p. 4.

[9] Ibid, p. 5.

[10] Ibid, pp. 8-9.

These same authors also summarize the worldview that Voluntary Simplicity represents. In an article in The Futurist, they present this worldview in terms of its contrasts with an "Industrial Worldview."[11]

Emphasis in Industrial World View	Emphasis in Voluntary Simplicity World View
Value Premises	***Value Premises***
Material growth	Material sufficiency coupled with psycho-spiritual growth
Man over nature	Man within nature
Competitive self-interest	Enlightened self-interest
Rugged individualism	Cooperative individualism
Rationalism	Rational and intuitive
Social Characteristics	***Social Characteristics***
Large, complex living and working environments	Smaller, less complex living and working environments
Growth of material complexity	Reduction of material complexity ("Ephemeralization")
Space-age technology	Appropriate technology
Identity defined by patterns of consumption	Identity found through inner and interpersonal discovery
Centralization of regulation and control at nation/state level	Greater local self-determination coupled with emerging global institutions
Specialized work roles—through division of labor	More integrated work roles (e.g., team assembly, multiple roles)
Secular	Balance of secular and spiritual
Mass produced, quickly obsolete, standardized products	Hand crafted, durable, unique products
Lifeboat ethic in foreign relations	Spaceship earth ethic
Cultural homogeneity, partial acceptance of diversity	Cultural heterogeneity, eager acceptance of diversity
High pressure, rat race existence	Laid back, relaxed existence

[11] Elgin, Duane S. and Mitchell, Arnold, "Voluntary Simplicity: Lifestyle of the Future?" in The Futurist, August 1977, p. 202.

c. The "Soft Path"

> "There exists today a body of energy technologies that have certain specific features in common and that offer great technical, economic, and political attractions, yet for which there is no generic term. For lack of a more satisfactory term, I shall call them 'soft' technologies....Energy paths dependent on soft technologies will be called 'soft' energy paths."[12]

The 'soft' path as described by Lovins combines a prompt and serious commitment to: efficient use of energy; rapid development of renewable energy sources matched in scale and in energy quality to end use needs; and special transitional fossil fuel technologies.[13]

ENERGY QUALITY

TRANSITIONAL TECHNOLOGY

Lovins argues that we could significantly reduce our energy demand with no sacrifice in quality of life and with very little dependence on non-renewable resources.[14] He advocates extensive exploration of alternative or "soft" energy sources in order to reduce the need for fossil fuel. This "soft" technology would be relatively decentralized, use renewable energy sources, be flexible in use and, to a certain degree, ownable and controllable by the operator.

"SOFT" TECHNOLOGY

He also specifically recommends the following as steps toward a successful soft technology society:

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[12] Lovins, Amory B., Soft Energy Paths: Toward A Durable Peace, Cambridge, Mass.: Ballinger Publ. Co., 1977, p. 38.

[13] Ibid, p. 25.

[14] For a discussion of renewable and non-renewable resources see Section 5a.

- Removal of institutional barriers to energy conservation
- Reduced use of high-quality energy (e.g., electricity) for uses that do not require it (e.g., low-temperature heat)
- Use of fossil fuels as a transitional technology to renewable energy sources
- Use of "technical fixes" to promote energy efficiency

TECHNICAL FIXES

Technical fixes are measures which use today's technology and have no significant effect on lifestyles, but do make contributions to a more efficient (conserving) use of energy. Examples of these technical fixes are thermal insulation, more efficient car engines and heat recovery in industrial processes.

ACTIVITY

FACILITATING NOTES

1. It is important that teachers read carefully pp. 71 to get an idea of what an adaptive strategy is and how it relates to a Stewardship Worldview before doing the specific readings.

2. The readings represent different approaches to the energy resource problem but have certain values in common. It is important that teachers recognize both the common values and the differences in methodologies among the selected strategies.

3. A good discussion should precede completion of the summary exercise on p. 88 so each teacher is very familiar with all three (3) strategies. The summary exercise, at this point, is intended as a quick review--a checkpoint. It may, however, lead to discussion as group members compare their ratings. There are no "right answers" for this exercise.

4. There is no "correct" answer to the summary. It is intended to review the notion of a Stewardship Worldview in relation to those strategies.

OBJECTIVE: (e) Be able to characterize three sample resource utilization strategies.

TO DO:

1. Each teacher completes one of the readings.
2. Based on the reading each teacher offers to the group a brief characterization of that adaptive strategy. (See Discussion Questions for each reading.)
3. Group discusses how each of these strategies seeks to implement the ideas and values of the stewardship worldview.
4. (Optional) Each group member explores a second reading of his or her choice.

READING I: Schumacher, E.F., Small is Beautiful: Economics as if People Mattered, 1973.

Part II, Chapter 5, "Technology with a Human Face," pp. 146-159.

"Objectives and Applicability," pp. 181-190.

Schumacher's book develops the theory and practice of Intermediate Technology. It deals with the economics appropriate to present resource conditions and contains insights into the need for restructuring our principles, actions, and dreams on a more equitable and rewarding basis.

The reading selected above provides a general discussion of the role of technology in modern society. It also offers Schumacher's rationale for movement toward a different, more human technology.

TO DO: Answer the following questions:

1. What is the threefold crisis precipitated by the systems of humanity and nature in conflict?

2. What are the differences between "technology of mass production" and "technology of production by the masses"?

3. How does Schumacher characterize the two worldviews: "people of the forward stampede" and "home-comers"?

4. What are some of the objections to Intermediate Technology?

5. What are the three possible approaches to the development of Intermediate Technology?

Summarize the key aspects of this adaptive strategy for the group.

- Define any new terms or specific ways common terms or phrases are used.
- Describe lifestyle implications of this strategy.
- Describe suggested ways to manage and consume energy resources at both institutional and individual levels.

READING II: Elgin, Duane, and Mitchell, Arnold, "Voluntary Simplicity (3)", The CoEvolution Quarterly, Summer 1977.

or

Elgin, Duane S. and Mitchell, Arnold, "Voluntary Simplicity: Lifestyle of the Future?", The Futurist, Vol. XI, No. 4, August 1977.

Read ONE of the above; the content of the articles is almost the same.

TO DO: Answer the following questions:

1. What are some of the societal problems that may push us in the direction of voluntary simplicity?

2. What effects would a large scale movement toward voluntary simplicity have on: values, consumption patterns, institutional operations, national policies, and global environment?

3. Why is voluntary simplicity "not a social panacea"?

Summarize the key aspects of this adaptive strategy for the group.

- Define any new terms or specific ways common terms or phrases are used.

- Describe the core values of voluntary simplicity: material simplicity, human scale, self-determination, ecological awareness, personal growth.

ACTIVITY (CONT'D.)

- Describe lifestyle implications of this strategy. (See Question 2 above.)

- Describe suggested ways to manage and conserve energy resources at both institutional and individual levels.

READING III: Lovins, Amory B., "Energy Strategy: The Road Not Taken?", appears in:

1) Not Man Apart, November 1976.

2) Soft Energy Paths: Toward A Durable Peace, Cambridge, Mass.: Ballinger Publishing Company, 1977, pp. 25-60.

TO DO: Answer the following questions:

1. How do the "soft" and "hard" energy paths differ?

2. How would "technical fixes" and "cogeneration" conserve energy?

3. Compare the two illustrations of U.S. Gross Primary Energy Use. How does the "schematic future" differ from the "alternate future" in terms of how much energy is used and what kinds of energy sources are tapped?

4. What does it mean to supply energy only in the quality needed for the task at hand?

Summarize the key aspects of this adaptive strategy for the group.

- Define any new terms or specific ways common terms or phrases are used.

ACTIVITY (CONT'D.)

- Describe the types of energy resource development the soft path advocates.

- Describe the energy-conserving strategies of the soft path.

- How does this adaptive strategy agree or disagree with the three "expert positions" or Position Profiles included in Section 1?

ADAPTIVE STRATEGIES

SUMMARY

Using the Stewardship Worldview characterization developed on p. 44 determine how closely each adaptive strategy adheres to the worldview by rating it as follows:

0 = Not mentioned in the strategy.
1 = Adherence to this worldview dimension but not a central focus of the strategy.
2 = Adherence and major focus of the strategy.

Characteristics of a Stewardship Worldview	Intermediate Technology	Voluntary Simplicity	Soft Path
"Finite Pie"			
Equity			
Nurture			
"Kindly Use"			
Use of Tools			
"Wholeness of Work"			
Individual Responsibility			
"Future is Now"			
Centralization/ Decentralization			
Energy-Conserving Lifestyle			

SECTION 4

RESOURCES

Commoner, Barry, The Closing Circle, New York: A. Knopf, 1971.

Dasmann, Raymond F., The Conservation Alternative, New York: John Wiley and Sons, Inc., 1975, pp. 19-29.

Dasmann, Raymond F., Planet in Peril, New York: World Publishing Co., 1972.

Ehrlich, Paul R., Ehrlich Anne H., Holdren, John P., Ecoscience: Population, Resources, Environment, San Francisco: W.H. Freeman and Co., 1970.

Greenwood, Ned and Edwards, J.M.B., Human Environments and Natural Systems, North Scituate, Mass., Duxbury Press, 1973.

Kormondy, Edward J., Concepts of Ecology, Englewood Cliffs, N.J.: Prentice-Hall, inc., 1969.

Miller, G. Tyler, Living in the Environment, Belmont, CA: Wadsworth Publishing Co., 1975.

Odum, Eugene P., Fundamentals of Ecology, 3rd edition, Philadelphia: W.B. Saunders Co., 1971.

Odum, Howard T., and Odum, Elisabeth C., Energy Basis for Man and Nature, New York: McGraw Hill Book Co., 1976.

Sutton, David B., and Harmon Paul N., Ecology: Selected Concepts, New York: John Wiley and Sons, Inc., 1973.

Varela, Francisco, "On Observing Natural Systems," CoEvolution Quarterly, Summer 1976, pp. 26-31.

SECTION 4

ECOSYSTEM STRUCTURE AND PROCESSES

Upon completing this section you will:

(f) Understand the major cycles and processes of our bio-physical life support system.

(g) Understand the principles of energetics.

This section describes the structure and functions of the natural systems and cycles on which we depend. It provides a knowledge base for appreciating the value of a stewardship approach to nature and for understanding the capacities and finite resource capabilities of natural ecosystems.

Intrinsic to an appreciation of a stewardship approach to protecting the natural environment and managing its resources is an understanding of natural ecosystems--the major components and energy processes, and the basis upon which natural ecosystems develop and maintain their stability.

a. Our Life Support System--the Biosphere

BIOSPHERE
LITHOSPHERE
HYDROSPHERE
ATMOSPHERE

The spherical shell of life for this planet, the biosphere, comprises an area having an approximate thickness of only nine miles. The biosphere extends from the surface layer of soil, minerals, and rocks (lithosphere), the oceans, lakes, and streams (hydrosphere) to a layer of gases and vapors (atmosphere) about seven miles high. The biosphere is a natural system at the planetary level. It contains all the elements necessary for organic life: solar energy, air, water, soil, heat, wind, and essential chemicals.

ECOSYSTEMS
BIOTIC
ABIOTIC

The biosphere can be visualized as a vast composite of diverse ecosystems. These ecosystems are self-sustaining natural systems with both living (biotic) and nonliving (abiotic) planetary resources. The nonliving components of the planetary ecosystem (nutrients, minerals, and inert materials) are contained within solid earth, water, and the atmosphere.

These, together with living organisms represent the total complex of factors operating within the ecosystem. Figure 1 below represents the interactions of the biotic and abiotic components in the natural ecosystem.

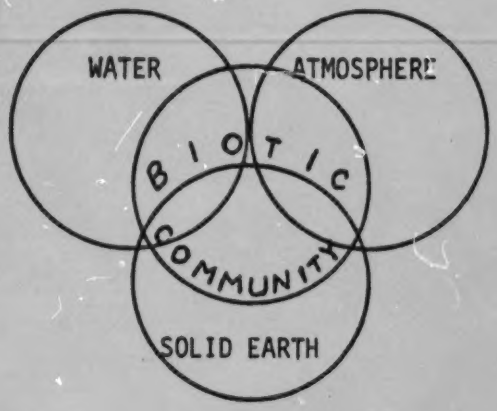


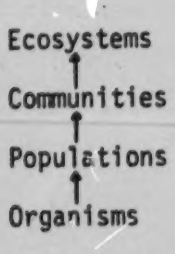
Figure 1.

Within the natural ecosystem several general types of ecosystems exist. For example: aquatic ecosystems include all predominantly waterborne life forms found in oceans, lakes, estuaries, ponds, rivers, coral reefs or swamps.

Terrestrial ecosystems exist on land; these include the majority of natural systems known to us: animals, humans, forests, grasslands, deserts, etc.

Atmospheric ecosystems support life forms that organize and spend their life cycles predominantly in the atmosphere.

Each natural ecosystem can be divided into smaller units. The usual levels of organization for ecosystems are:

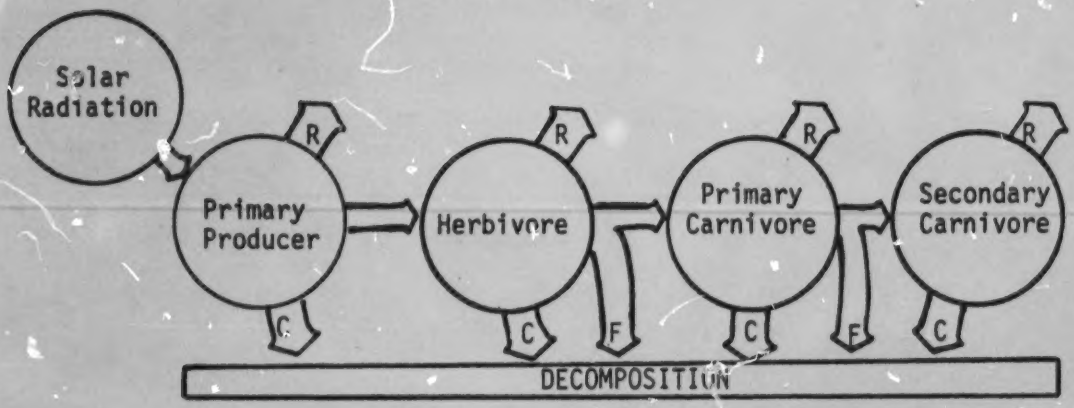


POPULATION

COMMUNITY

A group of individual organisms of the same kind is called a population. Different populations living together in a particular area create a natural community. The ecosystem is the total environment of the population or community and includes: all of the populations or biotic communities; all elements of the non-living environment; and all the interactions that bind the living and nonliving components together into a self-sustaining system.

Figure 2. The Food Chain



Food Chain Showing Inputs and Energy Losses

R=respiration F=feces C=decay

The food chain is an example of this flow of energy and material through the entire biotic community. The above diagram illustrates this pattern of energy flow, indicating the transfers of energy from one level to the next and the energy lost through respiration or decay.

The energy losses, especially through respiration, are considerable in this energy flow pattern. The "life" of this chain depends on the ability of each species to assimilate enough energy to offset these losses and to continue to grow and function. The limit is reached when the animals can no longer balance their energy expenditures with sufficient energy intake.

The organic wastes from this food chain are not lost to the ecosystem as a whole. They provide an energy source for a variety of soil organisms which degrade, or break down, this material into simpler compounds, carbon dioxide, water, and humus for the soil. This process releases nutrient elements such as nitrogen, phosphorous and sulfur into the environment to be reutilized by living organisms. It also promotes the storages of organic materials in the form of sediments. These sediments offer a permanent storage place for fixed carbon which is the source of our fossil fuels, and they also provide the mechanism for maintaining the oxygen in the earth's atmosphere.[1]

[1] Clapham, Natural Ecosystems, p. 36.

b. Energy Flows and Energetics in Natural Systems

A familiarity with the principles common to all systems is helpful when dealing with the structure and processes of complex ecosystems. As with any system, an ecosystem has boundaries, inputs and outputs, and interactions between its components. It is particularly important for an understanding of ecosystem functions to examine these systems in terms of: (1) energy flows and material cycling, (2) the principles of energetics, and (3) energy flow diagrams. The following discussion illustrates how these operate.

(1) Energy Flow and Cycling

ENERGY FLOW

Substances are constantly flowing through an ecosystem. The pattern of this matter and energy flow is the key to understanding the actual and potential "work" of the ecosystem. One type or pattern of energy flow is the linear input and output movement between systems or components of a system.

The nature of this energy flow pattern is unidirectional and includes substantial energy losses. It also carefully regulates itself, storing and cycling its nutrients into sediments for further use.

The energy source comes from outside the system.

CYCLING

Energy flows in one direction through an ecosystem, but some mineral nutrients are cycled, that is, they are reused again and again. An example of this natural system process is the continuous cycling of the chemicals necessary for life throughout the biosphere. Chemicals such as carbon, oxygen, hydrogen, nitrogen, sulfur, and phosphorus cannot be degraded. Furthermore, the supply of these elements is finite. "Therefore, the flow of these elements through the ecosystem must be cyclical, with matter constantly being reused."[2]

This flow of energy and cycling of materials through an ecosystem underscores the complex interrelatedness of the constituent parts of the system. It also points to the need to maintain a dynamic balance between these ecosystems and their environment. Any interruption or alteration to this natural flow of energy and nutrients through the ecosystem may be compensated for by existing natural feedback mechanisms or it may be of sufficient magnitude to destroy an ecosystem or disrupt the total balance in other ecosystems.

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[2]Ibid, p. 38. A detailed discussion of these cycles in nature can be found in Clapham, pp. 38ff.

(2) Principles of Energetics

There are three important laws or principles of energetics fundamental to the flow of energy in both natural and human systems.

(a) Law of Energy Conservation

According to the first law of thermodynamics, also known as the law of energy conservation, energy is a finite resource and can neither be created nor destroyed. Energy is merely transformed from one of its forms such as heat, light, mechanical, electrical, or chemical energy to another form.[3]

> The energy entering a system must be accounted for either as being stored there or as flowing out.

(b) Law of Energy Degradation

The second principle referred to as the Law of Energy Degradation (also called the Entropy Law) states that in all processes, some of the energy will be changed into a less concentrated form such as the heat of automobile exhaust or thermal power plant discharge.

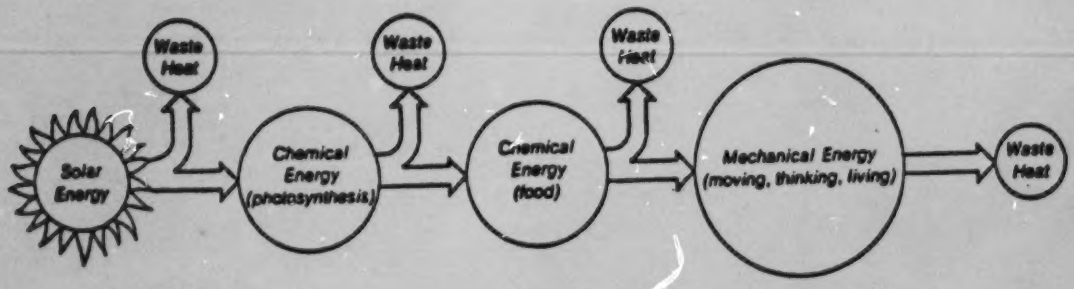
> "In all processes some of the energy loses its ability to do work and is degraded in quality."[4]

[3] G. Tyler Miller, Jr., Living in the Environment: Concepts, Problems, and Alternatives. Belmont, CA: Wadsworth Publishing Co., Inc., 1975.

[4] Odum and Odum, Energy Basis for Man and Nature, p. 38.

As illustrated in the diagram below (Figure 3.), all energy transformations are inefficient and add waste heat which is essentially useless energy to the environment.[5]

Figure 3. Process of Energy Degradation



This means, among other things, that more energy must be constantly expended to maintain order and prevent depreciation.

This law of energy degradation also recognizes the increasing disorder or randomness inherent in any system and its surroundings. This entropic tendency determines the ultimate limit of what we can and cannot do. It tells us, in fact:

> "...that maintaining order in the form of life always increases disorder in the surroundings. It also tells us that as we try to support more and more humans at higher levels of energy and resource consumption, the amount of disorder in our life-support system will automatically increase."[6]

The two laws of energetics imply that it should be possible to account for all energy that occurs in ecological systems (that is, where it comes from and where it goes) and that as energy flows through ecological systems, less and less of it will be available to do work at each successive step.[7]

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[5] Miller, Living in the Environment, p. 37.

[6] Ibid, p. 36.

[7] Sutton, D. B. and Harmon, N. P., Ecology: Selected Concepts, 1973, p. 40.

(c) Maximum Power Principle

The maximum power principle explains how systems survive by organizing themselves to utilize the available energy resources.

"That system survives which gets most energy and uses energy most effectively in competition with other systems."[8]

COMPETITION

This principle has the potential to predict what characteristics a system should have in order to compete successfully with neighboring systems for available resources. It also indicates that these competitive strategies must in fact change with the external energy conditions. To "get more energy" or develop more power inflow, for example, a system in an apparently abundant environment might:

- develop storages of high-quality energy
- use storages to increase energy flow (positive feedback)[9]
- use storages as a control mechanism to keep the system stable: inflows balance outflows (negative feedback)[10]
- recycle materials as needed.

COOPERATION

To "get more energy" when the system is in an apparently resource limited environment, different criteria come into play. In a limited or uncertain environment, system stability becomes important and competitive strategies are not helpful. Cooperation becomes favorable as a strategy for increasing the effectiveness of energy use through a programmed sharing of resources. In this situation a system might:

- develop symbiotic relationships with neighboring systems
- increase overall system efficiency of energy use (conservation)
- maintain stability by encouraging diversity and discouraging monotony
- develop feedback pathways to recycle resources.

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[8]Odum and Odum, Energy Basis for Man and Nature, p. 39.

[9]Positive feedback causes a system to change; to move away from a fixed point.

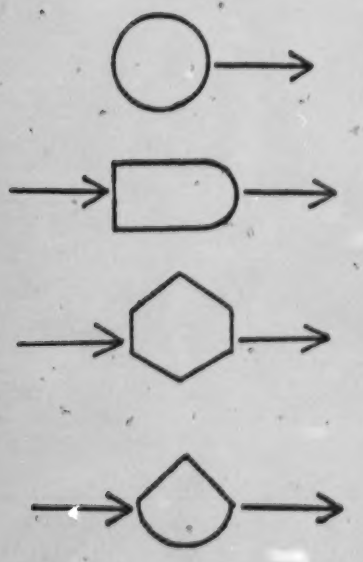
[10]Negative feedback causes a system to avoid change; to maintain a fixed point by correcting for deviations or fluctuations.

(3) Energy Flow Diagrams

A set of simple diagrammatic symbols can be useful as a standardized means of visualizing energy flow and depicting the behavior of whole energy systems. A diagram composed of such symbols can be used to model the interactions of resources and energy flows of any real life system.

A set of energy-oriented symbols has been developed by H.T. Odum to be used as a more precise method for diagramming the interactions of man and nature.[11] These symbols are based on the most common operations found in all systems that process resources and utilize energy.

The symbols[12] are representative of the following energy processes:



Sources of direct or stored energy from outside a system (e.g., sun, river, geysers, wind, fossil fuels)

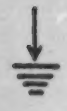
Production subsystem involving photosynthesis activities (e.g., farms, forests, coral reefs, biological communities of streams)

Self-maintaining consumer unit using energy produced elsewhere (e.g., people, animals, households, cities)

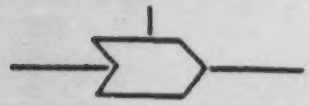
Energy storages within a system or subsystem (e.g., water tank, oil tank, library, manufactured structures)

[11] Odum, Howard T., and Odum, Elisabeth C., Energy Basis for Man and Nature, New York: McGraw-Hill Book Co., 1976.

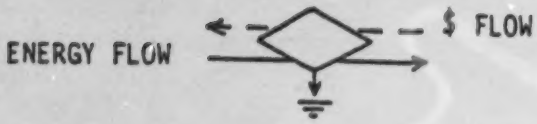
[12] See Odum, Howard T., Environment, Power, and Society, New York: Wiley-Interscience, 1971, for more detailed set of symbols.



Energy sinks (e.g., heat losses, wastes, degradations, dilutions)



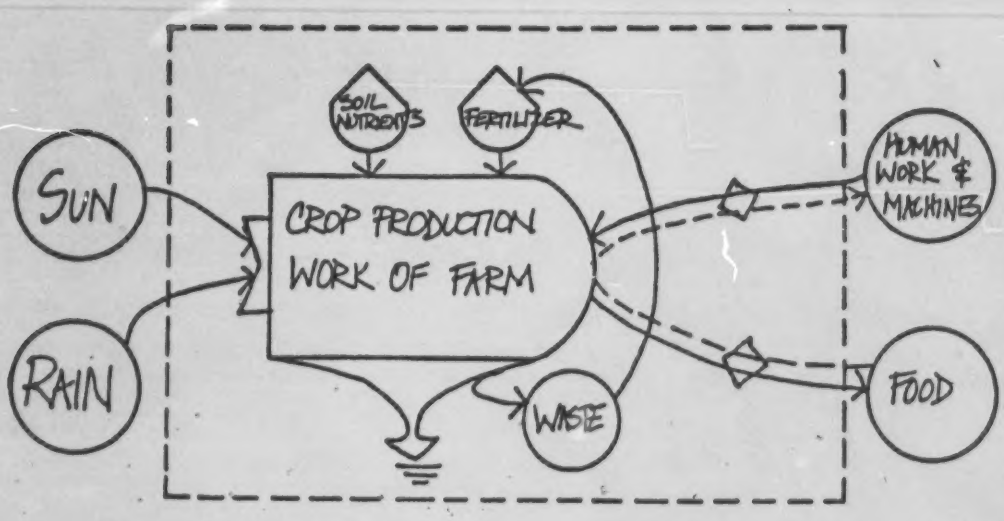
Interactions of energies flowing along pathways (e.g., in farming: interaction of sunlight, H_2O, soil, and machinery to produce food)



Flow of money in one direction to pay for energy flowing in the other direction.

The following example (figure 4) uses these symbols to show some processes and energy flows within a farm system:

Figure 4.



Energy input in the form of sun, rain, human work, and machinery (for planting, nurturing, harvesting, and processing the crops) flow into or enter the system. The human work and machinery are purchased. The sunlight and rain are provided free by nature. Nutrients stored in the soil and needed for crop production are also utilized by the system. The end products of crop production are the foodstuffs produced and offered for sale--part of the profits here are used to purchase more labor and machinery. Then agricultural waste materials need to be disposed of or recycled as fertilizer. A by-product of this production work is the energy lost in the form of heat at each stage of the crop production process.

c. Ecosystem Growth and Development

All natural systems are dynamic, being constantly engaged either in a state of growth and accumulation or in a state of balancing inputs and outputs in order to maintain structure and stability. The first of these states, growth and accumulation, can be examined through the system's characteristics and its processes of succession, climax, diversity, and simplicity.

SUCCESSION

Ecosystems change and grow through a process known as succession in which life forms (plants and animals) are continually succeeded or replaced with subsequent life forms over a long period of time until a more or less steady state relationship is reached by the life forms with their environment. This is known as climax condition. The development from initial life forms (early succession) to subsequent life forms (middle succession) to mature life forms (climax) occurs through competition for available resources (food and nutrients, sunlight, water, suitable temperatures, etc.). As the limits to the supply or abundance of these resources are reached, rival life forms enter a more steady state of cooperation in sharing these resources. This steady state of cooperation is characteristic of a climax ecosystem.

CLIMAX

DIVERSITY

Where the resources are abundant, a great diversity of life forms will evolve which can utilize the

full range of these resources. Where resources are scarce, however, only more simplified ecosystems (with fewer types of life forms) are able to be sustained.

SIMPLICITY

Ecosystems marked by simplicity tend to be much more susceptible to disruptions or periodic fluctuations in population since there are fewer species and, thus, fewer options available in the food chain. In an ecosystem marked by diversity, fluctuations in the size or population of any given species has relatively little impact on the ecosystem as a whole.

d. Ecosystem Stability and Equilibrium

> "We often view ecosystems as systems in dynamic equilibrium with their environment: that is, as systems that do not change, on the average, because the import and outflow of any parameter balance one another."[13]

Ecosystems that are in dynamic equilibrium may appear not to change very much, but the mechanics for achieving this kind of balance involve constant adjustments on the part of the ecosystem as it balances its surpluses with its deficits. One of the fundamental traits of natural system processes is the way in which these inbalances are overcome. The ability of natural systems to adapt, and to constantly adjust to changes in the environment is the result of long-term evolutionary processes.

Stability in an ecosystem implies persistence of its structure over time. Change occurs in the system, but the system's structure remains recognizable. The equilibrium, or balance of the system, is maintained, not as the result of sameness, but as the result of dynamic change and adaptation.

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[13]Clapham, Natural Ecosystems, p. 17.

> "If a system is to continue to exist it must maintain some kind of equilibrium; gain and loss must balance around some mean figure. There are limits to the amount of change that a system can tolerate. Because such tolerance limits exist, stabilizing factors that go into operation when the processes change place strains on a system. Hence equilibrium can be understood as the interaction of the process of change and the processes of stability."[14]

While the growth and development of ecosystems depend on their ability to capture and use energy (maximum power principle) and the abundance of resources, the stability of ecosystems depends also on their diversity (less diverse ecosystems are more susceptible to disruption) and on the presence of homeostatic or feedback mechanisms. One of the stabilizing agents of this dynamic equilibrium process is the system's natural feedback mechanism.

FEEDBACK

Any disturbance causing a system to return to its original state, is regarded as negative feedback. However, any disturbance generating further change or deviation from its original state, is regarded as positive feedback. Negative feedback is responsible for system maintenance; it regulates the system so that it will maintain its status quo. Positive feedback, instead of counteracting change, reinforces it. Positive feedback strengthens the thrust of the input. Harmful positive feedback is popularly called a "vicious circle" or the "snowballing effect;"

[14]Russwurm, Lorne H., and Sommerville, Edward, eds., Man's Natural Environment: A Systems Approach, North Scituate, MA: Duxbury Press, 1974, p. 11.

changes occur in the same direction at a compounding rate.[15]

The implications of having such runaway growth in an ecosystem are clear: without the dynamic regulation of negative feedback the system will expand beyond the limits of the ecosystem's environment and the stability of the ecosystem will be threatened. As the amount of structure increases, energy costs to maintain that structure increase even faster. Stability then, not overt growth, appears to be the most successful strategy of natural systems.

STABILITY

Thus, in interacting with the natural systems, it is necessary to maintain a proper respect for the often delicate mechanisms which keep these systems in equilibrium and functioning at peak efficiency. A knowledge of the workings of the ecosystem as a whole is necessary as a prelude to environmental decision-making with respect to the natural systems.

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[15] Ibid., p. 14.

ACTIVITIES

FACILITATING NOTES

- This section may seem like a shift in focus to some teachere. It might be a good idea to look at the Contextual Map on p. 240 for an overview of how this Natural Systems Conceptual section relates to the whole.

- Teachers whould read pp.92-103 prior to completing the exercises. If there seems to be difficulty with terms or concepts it may be advisable to have a group discussion before doing the reading.

- Activity I, p.111, is intended for individual clarification of ecosystem cycles and processes -- probably little or no discussion is required.

- The responses to the questions of Activity II should be shared by the group but not necessarily compiled together.

OBJECTIVE: (f) To understand the major cycles and processes of our biophysical life support system.

READINGS: Dasmann, Raymond F., Planet in Peril, 1972, Chapter 2, "The Biosphere," pp. 41-90.

Greenwood, Ned, and Edwards, J.M.B., Human Environments and Natural Systems, 1973, Chapter 3, "The Ecological Basis," pp. 40-67.

TO DO: Make a chart or a diagram which describes the major life support systems of the earth (atmosphere, hydrosphere, lithosphere) in terms of their:

- components (e.g., oceans, lakes, mountains, etc.)
- characteristics (e.g., precipitation, runoff, succession, diversity, energy flow patterns, etc.)
- interrelationships or interactions (e.g., hydrologic cycles, chemical and mineral cycles, etc.).

OBJECTIVE: (g) To understand the principles of energetics.

READING: Odum, Howard T., and Odum, Elisabeth C. Energy Basis for Man and Nature, 1976, Chapter 3, pp. 37-48.

TO DO:

1. For each of the processes below, briefly describe how potential energy is "degraded." That is, describe the forms of energy inputs, energy outputs, and energy losses: e.g., electrical energy (input)→mechanical energy (output) and ↓heat (energy loss) in the form of exhaust.
   - photosynthesis
   - food production
   - automobile operation
   - electric blender
2. Do the above processes tend toward order or disorder? How?
3. Give an example of a natural system maximizing energy for survival.

SECTION 5

SECTION 5

RESOURCES

Clark, Wilson. Energy for Survival. Garden City, NY: Anchor Press, 1974.

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Miller, G. Tyler. Living in the Environment. Belmont, CA: Wadsworth Publishing Co., 1975.

Steinhart, Carol; and Steinhart, John. Energy: Sources, Use and Role in Human Affairs. North Scituate, MA: Duxbury Press, 1974.

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Tuve, George. Energy, Environment, Populations and Food. New York: Wiley-Interscience Publications, 1976.

Van Deventer, Mary Lou, "Natural Resources" in Progress as if Survival Mattered, ed. Hugh Nash, San Francisco: Friends of the Earth, 1977.

SECTION 5

AVAILABLE ENERGY RESOURCES

Upon completing this section you will:

(h) Understand the availability of energy resources and the environmental advantages and disadvantages of their development.

(i) Understand energy resource delivery stages.

(j) Understand the extent to which recycling and resource recovery can conserve energy resources.

This section provides a profile of our energy resources including some current and proposed ways to employ these resources. It also supplies information on energy resource utilization's effects on the natural systems.

ENERGY RESOURCES

Most systems are built and maintained by a combination of natural and developed energy resources. When energy resources are plentiful, most systems increase their assets and growth; when energy resources are in short supply, activities decline and the systems use available energy for maintenance rather than growth or construction.

To help you understand the implications of energy resource development, we present here a brief introduction to the various types of resources. It is necessary to understand the nature of these resources, and their current and possible uses, as a background and integral part of any decision-making related to resource utilization. The development of most energy resources often involves difficulties in extraction or collection, or significant environmental costs to natural or human systems either during or after obtaining them.

a. Renewable and Non-Renewable Resources

Some energy resources exist in a natural state and some are by-products of other activities in our society.

We can define two categories of energy resources:

NON-RENEWABLE RESOURCES

- Non-renewable: The use of these resources is dependent on the amount of supply in existence. These finite reserves are made available to society as a function of available technology and capital investment.[1]

RENEWABLE RESOURCES

- Renewable: The use of these resources is determined by their rate of renewal. These infinite reserves are available at specific rates to humanity depending upon specific locale; their availability as an energy resource is also a function of available technology and capital investment.

[1] Lovins, Amory. "Energy Strategy: The Road Not Taken?" Foreign Affairs, Vol. 55, No. 1, October, 1976, pp. 65-96.

The following chart lists these renewable and nonrenewable energy resources:

NONRENEWABLE ENERGY RESOURCES	RENEWABLE ENERGY RESOURCES
Fossil fuels petroleum natural gas coal oil shale tar sands Nuclear energy fissionable materials fusionable materials	Solar energy Fresh water Wind power Oceanographic tidal power thermal gradient Geothermal energy steam heat Biomass Life forms human work photosynthesis

The most important distinctions between these types of resources are summarized below.

NON-RENEWABLE RESOURCES	RENEWABLE RESOURCES
• exist in the earth in limited quantities that could conceivably be used up	• will be available so long as the earth ecosystem continues to function
• comprise forms of high quality energy that have been historically easier to collect and use	• tend to be of higher entropy and require more effort and energy input for collection and use
• constraints on availability arise from necessary energy required to pump or dig them up	• available for use as fast as they are supplied by the natural system--for example, more wind or sunlight cannot be collected than passes through an area during a day

PRIMARY RESOURCES

These resources are often referred to as primary energy sources because they drive the production and delivery of energy. Secondary or tertiary energy resources are recycled energies from processes that are driven by either type (renewable or non-renewable) of primary resource. For example, the steam usually discarded as waste heat from a power plant can be re-used. It is not hot enough to drive the turbines; however, it is hot enough to heat the surrounding buildings. This is an example of a cogeneration system. These systems improve the overall energy efficiency of an energy delivery system by recycling energies that would otherwise have been lost to waste.

COGENERATION

Utilization of any of the above listed resources for energy production has a direct impact on the network of natural systems that either support its development as a resource or respond to the effects of its extraction or production.

In this section our previous and current resource utilization practices will be outlined with the intention of showing: (1) the actual or potential strain our current practices place on the natural systems,[2] and (2) the necessity of implementing an energy-conserving resource utilization pattern that emphasizes the "free work" of the natural systems[3] and the development of resource recovery technologies to increase our store of reusable materials.

FREE WORK

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[2]This section is not concerned with the effects of our energy utilization practices on systems other than the natural systems (i.e., economic, political, legal, transportation, etc.).

[3]Some ecologists (Eugene Odum, Ian McHarg) speak of the "work" performed by natural systems such as water catchment, water and air purification, erosion control, climate amelioration...etc. and argue that they should at least be valued at their "replacement value"--what it would cost to replace the "free work" being done.

b. Types of Energy Resources

CONVENTIONAL ENERGY RESOURCES

NON-CONVENTIONAL RESOURCES

Certain energy resources currently yield most of our energy supply. We will refer to these as "conventional" energy resources. Others are either contributing on a small scale or are being explored as to their availability and potential large-scale contribution. These have been termed "nonconventional" or "alternative" resources.* Following is a discussion about the nature of these energy resources. The first two are considered "conventional"; the latter (3-7) are considered "nonconventional." The resources discussed here are:

"Conventional" Energy Resources	Alternative Energy Resources
(1) Fossil Fuels	(3) Solar Energy
(2) Nuclear Energy	(4) Hydro Power
	(5) Wind Power
	(6) Geothermal Energy
	(7) Life Forms

*Executive Office of the President, Energy Policy and Planning, The National Energy Plan. Washington, D. C.: U.S.G.P.O., April 29, 1977, p. XIII.

(1) Fossil Fuels

The fossil fuels include the petroleum family of hydrocarbons classified as crude oil, natural gas, tar sands, coal, lignite, and oil shale. This brief overview considers them only in the general sense. Separate readings are cited that treat each in more depth.

Fossil fuels provide 96% of energy currently used in the United States.[4] Given rising energy demands and increased difficulty in extraction, we cannot continue to depend on these non-renewable resources.

The energy cost of extracting, producing, and delivering fossil fuels is high. The amount of energy required to deliver these fuels as products to the consumer means they are not "energy efficient."

ENERGY EFFICIENT

> "Fully 50 percent of a coal seam is lost in underground mining operations. Oil recovery is even less efficient: it is calculated that one-half the estimated reserves of crude petroleum in the United States will have been tapped by 1980, with less than one-quarter recovered for use. The most wastefully exploited of all the underground fuels has been natural gas. More of it has been flared off to permit easier access to liquid petroleum than has been harvested for consumption."[5]

Wasteful recovery and conversion of these resources is followed by further waste as the fossil fuel by-products are utilized inefficiently:

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[4]Greenwood, Ned; and Edwards, J.M.B. Human Environments and Natural Systems, 1973, p. 76.

[5]Ibid, p. 84.

"Energy conversion in the internal combusion engine is notoriously inefficient."[6]

Both short-term and long-term environmental consequences of extraction and production of fossil fuels make it an undesirable energy source for continued use on a large scale. Some of these environmental consequences are listed below:

(a) Air Pollution

In 1970 some 214 million tons of major pollutants were dumped into the air in this country alone.[7] The largest and most dangerous contributors are the automobile and the power plant, both of which are presently run by fossil fuel products.

The short-term effects of atmospheric pollution are evident in the air quality problems of our major cities or of the areas near the sites of large power plant installations.

The long-term effects of disturbing the atmosphere are not as visible as air pollution, but they also require our immediate attention. They include: (1) climate changes including rising temperatures from increased heat retention due to large amounts of carbon dioxide, a by-product of combustion; (2) health hazards for humans and animals from chemical poisoning (carbon monoxide) or toxic metals (lead, mercury); (3) interference with photosynthesis processes due to particulate build-up which increases the reflection of solar energy.

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[6]Ibid, p. 80.

[7]Major pollutants are: carbon monoxide, sulphur oxides, hydrocarbons, nitrogen oxides and particulates.

(b) Thermal Pollution

In addition to polluting the air, fossil fuel processes and by-products also pollute the land and water. Waste in the form of excess heat is expelled into aquatic ecosystems, usually raising the temperature of the water beyond the normal range and endangering the equilibrium of the systems. It has been calculated that "by the year 2000 the amount of excess (i.e., waste) heat emanating from all US power plants, regardless of type, would be enough to raise the temperature of the country's annual runoff by 20°F."[8]

While thermal pollution of the oceans is not a present threat, this kind of pollution in the lakes and rivers that are favorite sites for power stations is already a problem in some areas of the country.

(c) Environmental Degradation

A long-term environmental effect related to fossil fuel extraction is the degradation or destruction of the landscape.

> "In the case of strip mining, it seems, much can be done to reclaim the landscape so destroyed. But when the landscape has unique and irreplaceable features, the issue of conservation is presented in its starkest form."[9]

Some landscape, such as the Alaskan tundra, which was disturbed to lay an oil pipeline, is not replaceable. Other parts of the natural environment can be permanently damaged by pipeline breaks, oil spills or heat loss from hot oil pipelines which damages the vegetation and changes areas of frozen soil into potential mudslides.

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[8] Greenwood, p. 81.

[9] Ibid.

(2) Nuclear Energy

An alternative non-renewable, but seemingly inexhaustible, energy source is nuclear power. Nuclear energy in the form of nuclear fission could potentially provide most of our electrical energy in the coming decades.[10] There is, however, almost unanimous agreement that nuclear fission is also "potentially the most hazardous of all sources of energy and must be operated with no technological or human failures."[11]

NUCLEAR FISSION

Some of the environmental dangers of nuclear fission are the following:

(a) Leaks

Why is this process so risky? In the fission process, Uranium 235 atoms are split, releasing radiation and heat. The heat from this reaction can be used to produce electricity; the radiation however, is extremely hazardous, and can cause burns, illness and death with exposure to large amounts. Even exposure to small amounts of radiation can affect cell reproduction. There is no known method of counteracting the biological harmfulness of radioactive substances. As Miller points out, a nuclear accident that "could release extremely harzardous radioactive materials that might contaminate large areas for perhaps hundreds of thousands of years...is not in the same category as a dam collapse, explosion of a chemical plant, oil spill, rupture of a railroad car carrying poisonous chemicals, or other non-nuclear accidents."[12]

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[10] Miller, p. 234, "The Atomic Energy Commission projects that nuclear power will provide 20 percent of our electricity by 1980 and approximately 50 percent by 2000."

[11] Miller, p. 234.

[12] Ibid.

(b) Storage

The problem of nuclear safety is how to prevent radiation "leaks" or accidents which could happen on the plant sites, in transit, or at the storage sites. Some of these nuclear wastes take thousands of years to decay. Where can they safely be stored?

An advisory committee of the AEC specifies the wastes be "isolated from the biological environment." The alternatives for this storage would be:[13]

1. permanent burial in dry, earthquake-free geologic formations such as salt mines
2. storage in surface warehouses
3. burial under Antarctic ice sheets
4. burial in an underground hole created by a nuclear bomb
5. disposal in deep ocean trenches
6. shooting the wastes off into space
7. transmutation of harmful isotopes into harmless ones

Most of these alternatives do not, in fact, isolate these radioactive wastes from "the biological environment." They are still very much a part of the natural system environment of the biosphere.

(c) Thermal Pollution

In addition to the environmental dangers of leaks, there is the problem of nuclear waste in the form of thermal pollution. Because of the great amount of heat produced in a reactor, large amounts of water are needed to cool the power plant.

> "Compared to fossil fuel plants, the light water reactor nuclear plants now in use require much larger volumes of cooling water and emit about one and one-half times as much heat per unit of electricity generated, thus greatly increasing the potential for thermal water pollution."[14]

[13] For a brief consideration of these alternatives see Miller, pp. E 82-84.

[14] Miller, p. E 71.

Nuclear plants are located on rivers or lakes or beside the ocean in order to have access to the water needed for cooling. But they return the water at temperatures high enough to damage aquatic plant and animal life and disturb the balance of these ecosystems.

NUCLEAR FUSION

Producing energy by nuclear fusion is an alternative being explored. The fusion process is the same as that of the sun and stars.

> "This process involves compressing a thin, ionized gas composed of hydrogen-heavy atoms and heating it to a temperature higher than the interior of the sun, until the atoms collide with such impact that they fuse and release nuclear energy."[15]

The fusion process does not pollute the air and creates less radioactive wastes than nuclear fission. It does, however, release huge amounts of heat and would cause thermal pollution. Presently, the major obstacle to developing this energy source is the lack of a container for materials which reach a temperature of 180 million degrees, heat so great that it melts any known substance.

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[15] Greenwood, p. 87.

(3) Solar Energy

Areas of the country with an average of fairly high sunlight levels could utilize the sun's energy for heating or cooling buildings.

> "Even in the least favorable parts of the continental United States, far more sunlight falls on a typical building than is required to heat and cool it without supplement."[16]

Solar energy is collected, stored and circulated through a building either directly--if the structure has been designed for this purpose--or indirectly by using solar energy "hardware." According to Lovins, even if we design "passive" solar collectors (large south windows or glass-covered black south walls) into all new houses for the next 12 years, "we would save about as much energy as we expect to recover from the Alaskan North Slope."[17] This method is practical only on a small scale; storing sunlight for space heating and cooling on a large scale is difficult and impractical.

Solar energy can, however, be used for large scale electric power generation.

> "About 15 square miles of sunny desert could provide enough heat energy to run a large electric generating plant."[18]

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[16]Lovins, Amory. Soft Energy Paths: Toward a Durable Peace, 1977, p. 43-

[17]Ibid.

[18]Earth 2020: Faculty Institute Workbook, James H. Conley (ed.), Frederic Burk Foundation, Daly City, CA, p. 307.

POWER TOWER
SOLAR FARM

Experinments with solar power plants such as the "power tower" and the "solar farm" are examples of attempts to develop solar energy in a more centralized, high technology way.[19]

In addition to the problem of large-scale storage, these power plants are location-specific, that is, they are feasible only in semi-arid regions. Although they produce a clean fuel which would not pollute, the plants themselves have to be cooled and waste heat would be emitted into the air or the water supply.

SOLAR CELL

Another potential solar power source is the solar cell used for photovoltaic electricity generation.

> "Such cells generate electricity directly when sunlight falls on them. They have no moving parts, consume no fuel, produce no pollution, operate at environmental temperature, have long lifetimes, require little maintenance, and can be fashioned from silicon, the second most abundant element in the Earth's crust."[20]

Thus far, high costs have been the principal deterrant to widespread use of this solar option.

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[19]Hayes, Denis. Energy: The Solar Prospect. Worldwatch Paper #11, Washington, DC: Worldwatch Institute, March, 1977, pp. 21-22. A solar "power tower" uses a field of mirrors to focus sunlight on a boiler which produces high pressure steam to run a turbine to generate electricity. A "solar farm" uses rows of parabolic reflectors to direct concentrated sunlight onto pipes containing hot gases. Heat exchangers transfer the heat from pipes to storage tanks filled with molten metals which are used to generate high pressure steam to run a turbine.

[20]Ibid, p. 25.

The advantages of solar energy are its abundance and its small potential for environmental impact. It is an energy resource that can be made available in a form and at a scale appropriate to end use needs--that is, space heating and cooling can be accomodated on an individual or neighborhood scale without employing high-technology schemes. As a source for electrical power generation, solar energy is safe, dependable, renewable and non-polluting.

(4) Hydropower

Any fast-moving or falling water source can be tapped for direct energy. Hydropower accounts for about 23 percent of the world's electricity market. Hydro-electric development involves building dams and reservoirs on large rivers to capture the moving water and release it through turbines to produce electricity. There is a limit, however, to the feasible or desirable development of this resource. In fact, most of the large rivers in the industrialized world have already been harnessed to produce electricity.

The environmental problems associated with huge dams and reservoirs are summarized below:

> "Dams cannot be evaluated apart from their interaction with many other natural and artificial systems. They are just one component, albeit a vital one, of river basin management. Locks will have to be provided on navigable rivers, and fish ladders (one of the earliest victories of environmentalists) must be installed where dams block the spawning routes of anadromous fish. If a dam is located in a dry area, power generation must be coordinated with downstream irrigation needs. If a populated basin is to be flooded, the many needs of displaced people as well as the loss of fertile bottomland must be taken into account. Unpopulated basins are politically easier to dam, but in unsettled areas care must nevertheless be taken to preserve unique ecosystems and other irreplaceable resources."[21]

However, despite these problems, hydropower development has several assets: it is clean, it does not have storage problems, the conversion of

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[21] Worldwatch Paper #11, p. 39.

water power into electrical power is 85% efficient, and it can provide for flood control or irrigation.[22]

TEMPERATURE GRADIENTS

Aquatic ecosystems can also provide another source for power generation: electricity can be generated from temperature differences in the oceans. The temperature gradients between the cold water in the currents and the warm water that surrounds it is enough in some waters to turn a submerged generator. There is little disruption of natural systems, but it is difficult to transmit the power from ocean sites to land.

TIDES

Another potential source of hydroelectric power is in the tides. The gravitational pull of the sun and moon controls the massive and regular ebb and flow of billions of gallons of water. Harnessing this free energy source would provide a convenient and clean power source for local use. However, only a few areas have tides that could be used. The most favorable sites are large bays with narrow inlets and large tidal amplitude where a dam could be built across the mouth of the bay.

Channeling the normal tides would not necessarily destroy ecosystem functioning of an area, but it could have harmful effects on living things in the water.

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[22] See Worldwatch Paper #11, pp. 37-38 for discussion of liabilities and assets of the Aswan High Dam project.

(5) Wind Power

Wind can be captured by windmills and used to power wind generators for the production of electricity. Two of the problems associated with development of this resource are the limited number of possible sites that have sufficiently strong winds and the intermittent nature of the resource. The latter problem leads to the difficulty of wind storage.

Even if all available sites were utilized, the amount of electrical power produced would be less than one percent of the energy consumed in this country.[23] On the other hand, Hayes feels that political considerations, rather than wind availability, are the limiting factors to the growth of wind power. He recommends the use of wind turbines in conjunction with hydroelectric facilities and summarizes their environmental consequences as follows:

WIND TURBINES

> "Well-designed, well-placed wind turbines will achieve a high net energy output with an exceptionally mild environmental and climatic impact: wind machines produce no pollution, no hazardous materials, and little noise. In fact, the principal environmental consequences of wind power will be the comparatively modest ones associated with mining and refining the metals needed for wind turbine construction--ill effects associated with virtually every energy source...All things considered, a cleaner, safer, less disruptive source of energy is hard to imagine."[24]

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[23]Foin, Jr., Theodore C. Ecological Systems and the Environment, Boston: Houghton Miflin Co., 1976, p. 242.

[24]Hayes, D. Worldwatch Paper #11, p. 34.

(6) Geothermal Energy

The heat deep inside the earth is a vast potential source of power. Extraction of this heat or utilization of the steam for electricity generation has been used for heating purposes in a few select locations. Only certain areas have the underground conditions which allow this heat to come to the surface of the earth. As an energy source, it is useful only for limited periods of time; the heat content of a particular reservoir can be depleted after a few decades of active use. The reservoir well produces less as the heated water is drawn off faster than it is returned by rain and reheated.

An example of a geothermal power plant is the steam field in Northern California called The Geysers. "The total-electrical capacity at The Geysers is now about 500 megawatts. The total potential geothermal capacity at this location is estimated to be about 2000 megawatts, a capacity sufficient to serve one-half the present needs of the entire greater San Francisco metropolitan area."[25]

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[25]Energy Research and Development Administration, "Geothermal Energy," available from ERDA Technical Information Center, Oak Ridge, TN.

Undesirable environmental effects include disposal of waste water which has a substantial mineral content; discharge of gaseous substances into the air; and waste heat disposal from the power plant.

(7) Life Forms

In addition to being a direct energy source, the sun provides indirect energy by supporting the energy-producing process of photosynthesis. Plants photosynthesize about one-tenth of one percent of the solar energy that strikes the earth. Part of this energy is spent on the plant's metabolism. The rest is stored in potential "organic fuels."

PHOTOSYNTHESIS

ORGANIC FUELS

Potential organic fuels are of two types: waste materials and energy "crops" (grown specifically for their energy value). Waste materials that could serve as fuel include rubbish, garbage, manure and sewage from both urban and rural sources.

ENERGY CROPS

The most common energy "crop" is trees. The supply of trees is limited even though it is a renewable resource: its rate of production is slower than our present rate of energy consumption. The industrialized world as a whole does not rely on trees as a fuel source, but certain areas of the world do use firewood to cook food and heat homes. Deforestation has become a problem of world-wide dimensions. This country alone has already cut down at least half of its forest.

DEFORESTATION

Deforestation destroys ecosystems, erodes soil, and creates danger of flooding. "Kindly

use" management of timber resources is necessary because of the role of forests as ecosystem stabilizers: (1) they affect the climate by absorbing heat and producing oxygen, (2) they act as watersheds, (3) they provide habitats for wildlife.

In addition to trees, there are other "energy crops" which are considered to have good potential as energy resources. These include: sugar cane, sunflowers, water hyacinths, algae and seaweed.[26]

[26]For a discussion of these energy crops see Hayes, Worldwatch Paper #11, pp. 44ff.

c. Resource Delivery Systems

Energy resources, renewable or non-renewable, are "delivered" for use by the consumer via a series of stages--each of which "costs" energy. The delivery system stages are as follows:

EXPLORATION: siting of resource deposits, basic research and development of exploratory techniques, machinery

EXTRACTION: removing the resource, machinery and site equipment, materials, operating agencies, maintenance over the life of the site.

TRANSPORT I: transportation mechanisms and operating energy necessary to carry the resource to the next facility

PROCESSING: energy to run machinery, construction of the facility, its maintenance and operating energies

TRANSPORT II: transportation systems and the operating energies required to move the resource to the conversion plant

CONVERSION: plant construction, materials and maintenance

DISTRIBUTION: energy costs, equipment, storage facilities and networks to move the converted product from final facility to point of consumption

END USE: input to the "basic human needs" system

An example of energy delivery through these stages is the conversion of crude oil to electricity for individual consumer use:

EXPLORATION: geologic exploration for oil

EXTRACTION: tapping oil well

TRANSPORT I: shipment of crude oil

PROCESSING: processing of crude oil

TRANSPORT II: shipment of partially refined oil to a regional refinery

CONVERSION: transformation of oil into electricity

DISTRIBUTION: sale of electricity to a household

END USE: operate electric appliances

Every stage of the delivery system requires energy. The most significant costs are in the EXTRACTION, PROCESSING and CONVERSION stages. Each of these requires a large amount of energy to build and maintain structures. They are also the stages with the lowest energy efficiency; that is, energy losses in terms of heat and waste are highest for these steps.

An analysis of the delivery system stages in terms of energy expenditures will determine where energy is being wasted, and at the same time, will designate areas for potential energy conservation. This type of energy analysis, which is described below, can be applied to both direct and indirect energy products required for use in the industrial, commercial, residential, and transportation sectors of society.

(1) Net Energy Analysis

ENERGY PROFIT AND LOSS

An accounting technique analyzes the feasibility of energy production processes and delivery systems in terms of energy profit and loss. Just as an energy delivery system can be analyzed for its economic profitability, it can also be analyzed for its energy profitability.

GROSS ENERGY

The potential energy of a resource in the ground is its gross energy. This amount of energy is very different in quantity from what remains after all the delivery costs have been paid. The useful energy left after all these energy costs are subtracted is called

NET ENERGY

net energy. This, in calculating future energy supplies, the value of the resource cannot be determined without figuring the energy required for processing and transporting the energy to consumers. This is an important consideration in determining allocation and utilization of resources. Although the oil shale and coal reserves may appear large, "in fact, the energy required to bring more oil, natural gas, and coal from the earth into use may be more than the value of the energy in the fossil fuel reserves themselves."[27] The true value of any energy source is the net energy available for use. This is referred to as the net energy profit of the particular gross energy production.

Determining the net energy of any deliverable energy product--food, cars, electricity, etc.--takes into account that "it takes energy to get energy." And, in accordance with the first law of thermodynamics, this energy must be accounted for as staying in the system or flowing out. A net energy analysis, then, determines a resource's yield by accounting for its waste heat losses during production and the additional inputs required from other energy sources.

NET ENERGY ANALYSIS

Odum uses energy diagrams to trace the energy flows required for producing goods or for operating a system. This visual tool is helpful in showing the

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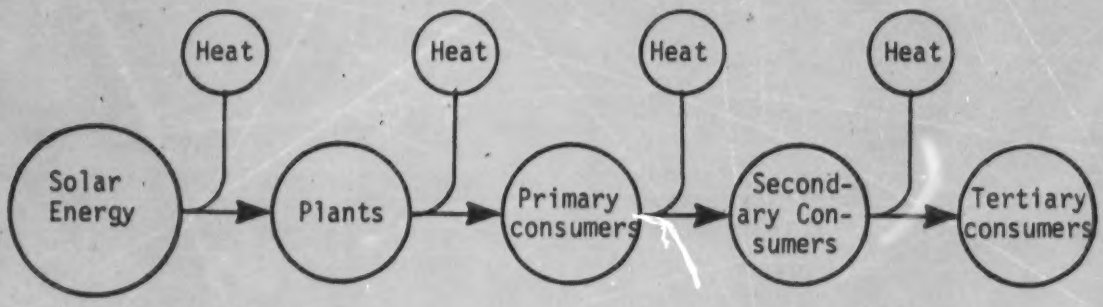
[27]Clark, Wilson. Energy for Survival, p. xv.

energy flows of materials and the work that must be included in the energy cost of a system and its operation.[28]

(2) Energy Quality

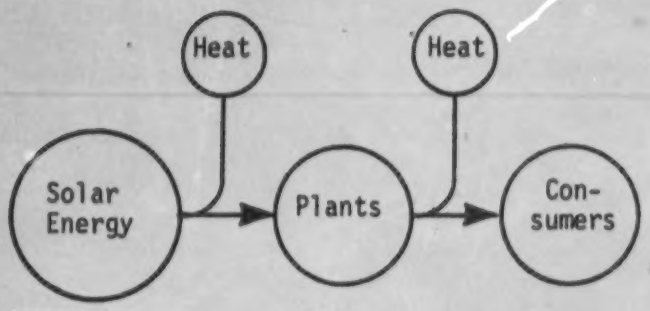
Another way to compare different energy forms is to consider their qualities of energy. As energy resources are transformed by work, their quality changes. The quality of energy is measured by its potential to do work. Different forms of energy such as sunlight, plants, and electricity have different energy qualities.

A calorie of dispersed heat cannot do work; a calorie of sunlight can do work if it is collected; a calorie of coal is already highly concentrated and can do much useful work. Each of these energy forms has different qualities. In accordance with the second law of thermodynamics--the energy degradation law--each time we transform energy from one form to another, the quality is degraded with much of the energy lost as waste heat to the environment. Thus, the longer the energy transform chain, the more energy that is degraded and lost as low-quality heat.



[28] See Odum and Odum, p. 34 for a diagram of the hidden energy flows required to operate an automobile.

This energy waste can be decreased by keeping the energy transfer chain as short as possible.



Additional energy from other sources can be used to "work" on energy forms of lower quality to upgrade them. For example, some energy forms such as solar energy, wind power or oil shale are dilute forms of energy and need to be concentrated in order to do work. The more work that is required to upgrade the energy form and make it more flexible, the higher the quality of energy product. Electricity, for example, is a high-quality, flexible energy form: great amounts of energy have been required in order to produce electricity from oil or coal--to concentrate a dilute energy source into a useful and highly flexible form of energy.

In order for this process to occur, there has been considerable degradation of energy as this high-quality concentrated form of energy is produced. In terms of energy costs, then, electricity is a very expensive product and should be used only for tasks with a high-quality energy

requirement--not for opening cans or carving meat. The concept of energy quality, in terms of energy-conserving resource utilization, stresses the importance of using energy products for tasks that require their specific energy quality.

d. Recycling and Resource Recovery

> "Our fundamental dilemma is that we have built an open system not unlike the digestive tract of an earthworm: one end gobbles up resources and the other end ejects wastes. Were our resources infinite, as the earth must seem to a worm, that would do. But our resources are finite, so we must find ways to approximate the worm Ourobouros, which was said to eat its own tail and never run out of food. We must join the ends of our system so our wastes become resources."[29]

"WE MUST JOIN THE ENDS OF OUR SYSTEM SO OUR WASTES BECOME RESOURCES"

How can we close the loop? Solid wastes that are not recovered add to the waste disposal problem and they also negate the use of a potential energy resource: "While our cities debate where to put the next landfill, they ignore the vast potential of the waste they try so hard to hide."[30]

Much of the urban and agricultural waste materials could in fact be recycled back into the system. Recycling of wastes is the most environmentally sound approach to ridding ourselves of hazardous wastes. Some principal waste materials that can be recycled are listed in the following table.[31]

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[29] Friends of the Earth, Progress as if Survival Mattered, ed. Hugh Nash, San Francisco: Friends of the Earth, 1977, p. 70.

[30] Ibid, p. 68.

[31] Foin, p. 336.

Material	Percent Municipal Waste	Percent Recycled
Paper	40-50%	19
Ferrous metals	7%	20
Nonferrous metals	<1%	30.8
Glass	6%	4.2
Textiles	.6%	4.3
Rubber	1%	26.1
Plastics	1.1%	unknown

The following is an example of the potential for recycling paper:

> "Every Sunday edition of the New York Times consumes 150 acres of forest. Recycling a stack of newspapers only 36 inches high saves one tree. If we increased the amount of paper recycled from 20 percent to 50 percent we would save an additional 300 million trees a year."[33]

Recycling aluminum cans and non-returnable bottles is a helpful practice since they make up from 10-20 percent of household and commercial refuse. It would be more ecologically sound, however, to ban these throwaways altogether and re-instate returnable bottles.[33] In 1971 the State of Oregon passed a law that bans all no-deposit, no-return bottles and cans.

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[32] Miller, p. E62.

[33] Hannon, Bruce M., "Bottles, Cans, Energy" in Environment, vol. 14, no. 2, March, 1972, pp. 11-21.

"After only six months the Oregon Environmental Council and the Environmental Protection Agency found that cans dropped from 40 to 3 percent of the beer and soft drink market and throwaway bottles became nonexistent. Litter was down dramatically with 81 percent fewer cans and bottles found on roads and highways."[34]

Abandoned automobiles are not only an environmental eyesore but also a waste of recoverable materials in the form of rubber, lead, zinc, steel, nickel, aluminum and copper. About 85% of these retired vehicles are reclaimed, but there still remains "about $1 billion of reusable metals" in 12 to 20 million automobile hulks scattered across the country."[35]

Organic solid waste materials such as animal excrement, agricultural residues, human sewage and paper production residues can be "recycled" as sources of energy. However, because of the Second Law of Thermodynamics--the law of degradation of energy--these materials are less useful the second time around. Recycling of materials and resource recovery are good energy-conserving measures, but in terms of protecting our finite resources and minimizing environmental damage, it is imperative to hold as many materials as possible in the first cycle as long as possible. Reuse the goods several times before breaking them down into raw materials for another cycle.

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[34] Miller, p. E64.

[35] Ibid, p. E65.

The following are some kinds of solid waste that can be recycled as fuels:

(a) Agricultural residues--the unharvested or inedible parts of food crops as well as animal excrement--[36] are the largest potential source of organic fuel. They do have secondary uses, however, which limits the supply available for resource recovery: they are used to feed livestock, retard erosion or enrich the soil. Wisely used, however, these residues can be made to serve several "secondary" purposes. For example, methane gas can be generated from animal excrement without removing the nutrients. It can then be returned to the soil as fertilizer.

(b) Lumber and paper residues can be used as fuel at the production site: a study conducted for the Ford Foundation's Energy Policy Project found that if the paper industry were to use its wood wastes as fuel, fossil fuel consumption could be reduced by a staggering 75 percent.[37] Paper can be recycled or it can be mixed with other burnable garbage and used to produce heat or electricity.

(c) Municipal waste including sewage and burnable refuse can be exploited as energy resources. Solids removed from sewage during waste water treatment can be used to produce a sludge which can be used as a replacement for chemical fertilizers which are more expensive in money and energy. Application of sludge to the land is not contaminating; it does, however, require the removal of heavy metals from the sewage system. Both sludge and refuse can be burned as fuels. St. Louis, for example, processed 325 tons of garbage each day, recovering metals for recycling, while burning enough organic matter to make electricity to power the equivalent of 25,000 homes.[38]

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[36] Hayes, Worldwatch Paper #11, p. 41.

[37] Ibid, p. 43.

[38] Wallace, Daniel, "Waste as an Energy Resource" in Energy We Can Live With, ed. Daniel Wallace, Emmaus, Pa.: Rodale Press, 1976, pp. 28-30.

ACTIVITY

SECTION 5

FACILITATING NOTES

Activity I:

- Teachers should read pp. 119-135 prior to completing the activities

- Teachers may want to further break down the resource categories within the given divisions, e.g., petroleum to include shale and tar sands or nuclear to distinguish fission from fusion.

OBJECTIVE: (h) Understand the availability of energy resources and the environmental advantages and disadvantages of their development.

READINGS: Ehrlich, Paul; Ehrlich, Anne, and Holdren, John. Ecoscience, pp. 400-411, 471-480.

Miller, G. Tyler. Living in the Environment, 1975, pp. 231-232 (Tables 13-2 and 13-3).

Steinhart, Carol; and Steinhart, John. Energy: Sources, Use, and Role in Human Affairs, 1974, pp. 91-186.

TO DO:

1. Refer to the energy resources described on p. 119. The group should then choose any four resources and divide these among the group.

2. Have subgroups read the appropriate sections on each resource in Ehrlich and Steinhart, and all teachers refer to the Tables in Miller, pp. 231-232. Focus your reading on the questions below to help screen out extraneous information.

3. Each subgroup answer the following questions about their resource by filling in the matrix following on page 151. One example is provided in brief form.

    - Is the resource renewable or nonrenewable? Include a short statement about the nature of the resource that indicates a reason for its renewability or nonrenewability.
    - What are some of the final energy uses of this resource?
    - What is the short-term and long-term availability of this resource?
    - What are some environmental advantages to using this energy resource?
    - What are some environmental disadvantages?

4. As a group, discuss the similarities and differences of each resource. You may want to fill in the blank spaces on your own charts for each resource.

5. After the group discussion, list the resources you chose for this activity in decreasing order with respect to detrimental environmental impact.

6. List these in decreasing order with respect to potential supply.

7. Discuss which ones seem to offer the best compromise between availability and environmental impact.

ENERGY RESOURCE	RENEWABLE NON-RENEWABLE	LIST SOME END USES	POTENTIAL RESOURCE AVAILABILITY	ENVIRONMENTAL ADVANTAGES	ENVIRONMENTAL DISADVANTAGES
Petroleum	Non-renewable	gasoline, fuel oil, plastics, petro-chemical products	20 years at current rate; short term		Damage from exploration, oil spill, air and water pollution, landscape destruction
Natural Gas					
Coal					
Nuclear					
Wood					
Waste					
Wind					
Tides					
Hydropower					
Geothermal					
Solar					

FACILITATING NOTES

Activity II:

Activity II is similar to one presented in the module Energy Resource Delivery and Use. If teachers have completed that module, this Activity can serve as a review.

TO DO:

1. Group selects at least 4 energy resources from the charts that follow and divides into sub-groups to consider the delivery of two of these resources--one "conventional" and one "alternative" resource.

2. Examine the delivery system charts (Figures 1&2) for your selected resources and fill in the chart by considering the following:

   a. What are some economic considerations and environmental consequences of delivering this resource?

   b. At what stages of delivery are there changes in the energy quality of the resource?

   c. At what stages of delivery are there losses of potential energy to degradation and/or physical waste? Indicate which types of loss. What are some of the final energy forms of this resource?

   d. At what stages of delivery could recycling or conservation efforts occur? What would they be?

OBJECTIVE: (i) Understand resource delivery system stages.

READING: Ehrlich, Paul R.; Ehrlich, Anne H.; and Holdren, John P. Ecoscience: Population, Resources, Environment. San Francisco: W.H. Freeman and Co., 1970, pp. 411-489. (Read portions pertaining to your selected resources.)

TO DO: (See preceding page.)

ENERGY RESOURCE	ECONOMIC CONSIDERATION/ ENVIRONMENTAL CONSEQUENCES	STAGES OF ENERGY QUALITY OF CHANGE	STAGES OF POTENTIAL ENERGY LOSS	FINAL ENERGY FORMS	STAGES FOR RECYCLING/CONSERVATION
1. Surface Coal	high original quality--concentrated energy potential	extraction transport processing conversion	incomplete extraction or spillage spillage waste heat, incomplete cleaning for processing waste heat, low BTU, gas waste, waste steam	electricity coal gas	transport-slurry processing-solvent refining conversion-low BTU gas for nearby electric plants
2.					

DELIVERY STAGE → / ENERGY RESOURCE ↓	EXPLORATION	EXTRACTION	TRANSPORT I
PETROLEUM	Seismic or other exploration for oil deposits, exploratory drilling and estimation of reserves	Drilling and operation of oil wells	Transport of crude oil to refineries by pipeline, tankers, trains, or trucks
NATURAL GAS	Geological exploration and drilling to locate gas reserves, often in conjunction with petroleum exploration	Production of natural gas from gas or oil wells; separatior of gas from oil	Transport of natural gas to processing stations by pipeline
LIQUIFIED NATURAL GAS (LNG)	Geological exploration and drilling to locate gas reserves, often in conjunction with petroleum exploration	Production of natural gas from gas or oil wells; separation of gas from oil	Transport of natural gas to processing by pipeline
COAL (TO ELECTRICITY)	Geologic exploration and siting of underground and surface coal deposits; estimation of deposit size	Construction and operation of underground or surface mines	Transport of raw coal to cleaning facilities by conveyor, slurry pipeline, truck or unit trains
HYDROELECTRIC POWER	Location and assessment of rivers with hydroelectric potential	Construction of a dam and associated turbines and generators	NA
NUCLEAR ENERGY (CONVERTER REACTOR)	Geologic/radioactive location of uranium deposits	Mining of uranium ore and milling to produce U_3O_8	Transport by special container on trucks or trains to processing facilities
NUCLEAR ENERGY (BREEDER REACTOR)	Geologic/radioactive location of uranium deposits; also utilization of ore tailings from converter reactor fuel processing	Mining and milling of uranium ore; extraction of plutonium from spent reactor fuel; reclamation of ^{238}U tailings from converter reactor fuel enrichment process	Transport of uranium and plutonium in special containers by trucks or trains to processing facilities

[1] NOTE: ASTERISKS IN THIS SECTION INDICATE A BROAD SCALE OF COMPLEXITY IN PROCESSING
* SIMPLE
** MORE COMPLEX OR INTENSIVE
*** HIGHLY COMPLEX

FIGURE 1 CONVENTIONAL DELIVERY SYSTEMS (Cont. on next page)

PROCESSING[1]	TRANSPORT II	CONVERSION	DISTRIBUTION
Refining of crude oil into various products ••	Transport of refined products by pipeline, train or truck to conversion facilities or distribution points	Direct combustion in industrial boilers or production of heat to power or steam-turbine electrical generation plant	Transmission via the electrical grid or by service station, fuel oil, etc., facilities for liquid products
Processing to remove contaminants and liquids •	Transport to conversion facilities or end-use location by pipeline	Direct combustion to produce steam to power or steam-turbine electrical generation plant	Transmission via the electrical grid or by pipeline to direct uses
Processing to remove contaminants and liquids; liquifaction ••	Transport by LNG tanker to coastal ports	Vaporization (return to gaseous state)	Distribution by pipeline to direct end-uses or to further conversion to electricity
Cleaning of raw coal to remove impurities and, if applicable, separation from slurry fluid •	Transport of clean coal to conversion facilities by conveyor, truck, or unit train	Direct combustion to produce heat to power or steam-turbine electrical generation plant; or gasification of coal then used for electrical production or for other gas uses	Transmission via the electrical grid or gas pipelines for coal gas
NA	NA	Operation of the power plant at the dam	Transmission via the electrical grid
Enrichment of ^{235}U in U_3O_8; fabrication of fuel rods; reprocessing of spent fuel; waste disposal •••	Shipment of fuel rods by guarded train	Production of steam from fission heat to power electrical generating turbines	Transmission via the electrical grid
Fabrication of fuel rods from uranium and plutonium; waste disposal •••	Transport of fuel rods in special guarded containers by train	Production of steam from fission heat to power electrical generating turbines	Transmission of electricity via the grid

FIGURE 1 continued

DELIVERY STAGE → / ENERGY RESOURCE ↓	EXPLORATION	EXTRACTION	TRANSPORT I
COAL (GASIFICATION)	Geologic exploration and siting of underground and surface coal deposits; estimation of deposit size	Construction and operation of underground or surface mines	Transport of raw coal to gasification plant by conveyors, slurry pipeline, truck, or unit train
COAL (LIQUIFACTION)	Geologic exploration and siting of underground and surface coal deposits; estimation of deposit size	Construction and operation of underground or surface mines	Transport of raw coal to liquifaction plant by conveyor, slurry pipeline, truck, or unit train
OIL SHALE	Geologic location and assessment of oil shale deposits	Construction and operation of oil shale mines and retorting facilities; or in situ retorting of shale	Transport of oil shale to retort facilities by truck or pipeline (not applicable for in situ retorting)
TAR SANDS	Geologic location and assessment of tar sand deposits	Construction of tar sand extraction facilities; extraction by slurry mining or in situ	Transport of tar sands to processing site (not applicable for in situ recovery)
SOLAR ENERGY (SMALL SCALE)	Location of sunward exposures for placement of collectors or windows	Erection of sunlight collecting devices or construction of windows and storage medium	Piping of heat collection fluid to house or other site; storage
SOLAR ENERGY (LARGE SCALE)	Location and assessment of areas with proper solar insulation	Construction of large sunlight collection surfaces, central boiler, and steam-electric generation system	NA
PHOTOVOLTAIC CELLS	Location of required minerals, e.g., silicon	Mining of required materials	Transport of minerals to production facilities

1: COMMUNITY SCALE: PROCESSING
* SIMPLE
** MORE COMPLEX OR INTENSIVE
*** HIGHLY COMPLEX

FIGURE 2 NONCONVENTIONAL DELIVERY SYSTEMS (Continued on next 3 pages)

PROCESSING[1]	TRANSPORT II	CONVERSION	DISTRIBUTION
Production of synthetic natural gas from coal by gasification, hydro-gasification, or pyrolysis; gas purification; and production of methane ∞	Transport of coal-gas by pipeline to conversion or end-use site	Direct combustion of gas for space heating close to processing site, or production of electricity by combined gas-steam turbine	Transmission of electricity via the grid
Production of synthetic petroleum by the synthesis gas process, pyrolysis, or hydrogenation ∞	Transport of liquid and some gaseous products to conversion or end-use sites by pipeline	Direct combustion as petroleum fuels or production of electricity from combustion heat in a steam generator	Distribution of liquid fuels via gasoline, fuel oil system; transmission of electricity via the grid
Production of synthetic oil by pyrolysis of shale; refinement into various petroleum products ∞	Transport of liquid fuels to conversion and end-use sites	Direct combustion of fuels for heating, vehicles, etc.; or production of steam for electricity generation	Transmission of electricity via the grid, or liquid fuels distributed by commercial networks
Production of bitumen (tar) from sand via several alternate processes; refinement of tar into various petroleum products ∞	Transport of petroleum products (gas and liquid) to conversion or end-use sites	Direct combustion of fuels for heating, vehicles, etc.; or production of steam for electricity generation	Transmission of electricity via the grid, or liquid fuels distributed by commercial networks
NA	NA	NA	Delivery of heat in fluid to space, or direct heating of space by sunlight
NA	NA	Electricity generation from steam	Transmission of electricity via the grid
Manufacture of solar cells ∞	NA	NA	Commercial distribution and sales of solar cells for direct energy production at end-use sites

FIGURE 2 continued

DELIVERY STAGE → / ENERGY RESOURCE ↓	EXPLORATION	EXTRACTION	TRANSPORT I
HYDROGEN FUEL	NA	Collection of water and other materials for hydrogen production from water	Pumping of water to dissociation site
WINDPOWER (SMALL SCALE)	Location of best wind collection areas	Erection of one or several small windmills to drive electrical generators	NA
WINDPOWER (LARGE SCALE)	Location and assessment of windy geographical areas	Construction of one or several windmills to drive electrical generators	NA
TIDAL POWER	Location and assessment of coastal areas with tidal power potential	Construction of generation stations to utilize tidal gradients	NA
OCEAN THERMAL	Location and assessment of ocean areas with adequate temperature gradients	Construction of generation stations in proper ocean areas	NA
GEOTHERMAL	Geologic location of geothermal areas and assessment of resource potential	Drilling and operation of geothermal wells	NA
BIOMASS	NA	Collection of combustible refuse from urban, industrial, or agricultural waste	Transport of wastes to conversion site
FUEL CELLS	Geologic location of necessary fuel cell component materials such as platinum, potassium, or nickel	Extraction of necessary minerals	Transport of materials to fuel cell assembly site

FIGURE 2 continued

PROCESSING	TRANSPORT I	CONVERSION	DISTRIBUTION
Dissociation of water into hydrogen and oxygen by electrolysis, bioconversion, or ultraviolet light **	NA	NA	Transport of hydrogen to end-use sites via pipeline, truck, or train
NA	NA	Operation of windmills	Connection to house or other end-use site electrical system and/or storage batteries
NA	NA	Operation of windmills	Transmission of electricity via the grid
NA	NA	Operation of generators	Transmission of electricity via the grid
NA	NA	Operation of generators	Transmission of electricity to shore, tapped into land grid
NA	NA	Production of electricity from geothermal steam, or steam produced from geothermal heat	Transmission of electricity via the grid, or distribution of geothermal steam by pipeline to direct space heating sites
Production of methanol by distillation, or direct combustion of refuse *	Transport of methanol to end-use or conversion sites	Combustion of refuse or methanol to produce steam for electricity or for direct space heat	Transmission of electricity via the grid, or liquid fuels distributed by commercial networks
Assembly of fuel cells from constituent parts *	NA	NA	Commercial distribution of fuel cells to end-use sites

FIGURE 2 continued

ACTIVITY

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FACILITATING NOTES

Activity III:

ALL teachers should read the Hannon article. This is a key point in beginning to assess energy conserving strategies. Take as much time as needed to clarify the implications of recycling/resource recovery/ refilling bottles and cans.

OBJECTIVE: (j) Understand the extent to which recycling and resource recovery can conserve energy resources

READING: Hannon, Bruce M. "Bottles, Cans, Energy," Environment, Vol. 14, No. 2, March, 1972, 11-21.

TO DO:

1. What is the difference between recycling and refilling bottles? Which is more energy-efficient?
2. Table Two (in the reading) presents a summary of the energy costs to deliver both returnables and throwaways. Which delivery stages show the greatest difference in energy cost? What accounts for these differences?
3. What is the position of the following groups regarding returnable/throwaway containers:
   - inner-city dwellers
   - suburbanites
   - retailers
   - bottlers
4. How would a conversion to returnable bottles affect the energy requirements of the beverage industry?

SECTION 6

RESOURCES

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SECTION 6

HUMAN SYSTEMS IMPACT ON RESOURCE UTILIZATION

Upon completing this section you will:

(k) Understand the relationship between income and indirect energy usage.

(l) Recognize potential areas for conservation at the individual household level.

(m) Be able to characterize some "new" economic models.

(n) Understand some of the legal and political impediments to implementing an energy-conserving resource utilization policy.

This section will explore ways in which individual and aggregate level human systems are supportive of, or counter-productive to, the implementation of energy-conserving policies and practices.

To determine how human system activities relate to energy resource utilization, we here consider the impact of energy-related decisions at both the individual household level and the institutional level. The purpose of this section is to explore ways in which individual and aggregate actions are either supportive of or counterproductive to the implementation of energy conserving policies and practices. We explore some of the underlying assumptions, motivations and lifestyle demands that shape consumer decisions and institutional concerns.

a. Individual Household Level

> "Energy use in the seventy million homes of America is substantial, taking about one fifth of the national total for all sources of energy and about one third of all electricity generated."[1]

Individuals, through their purchases of goods and services, control a large proportion of the total energy used in the United States. This section will look at two important aspects of individual energy consumption:

- the direct and indirect personal uses of energy to satisfy our human needs
- how this energy usage is related to income.

(1) Energy Usage

Personal energy usage is directly related to satisfying human needs which are a composite of biological requirements and societal needs. An array of the basic human needs and the socially derived needs upon which energy is spent appear on the following page with some of the means of satisfying these needs.[2]

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[1]Clark, Wilson. Energy for Survival: the Alternative to Extinction. Garden City, NY: Anchor Press/Doubleday, 1974, p. 182.

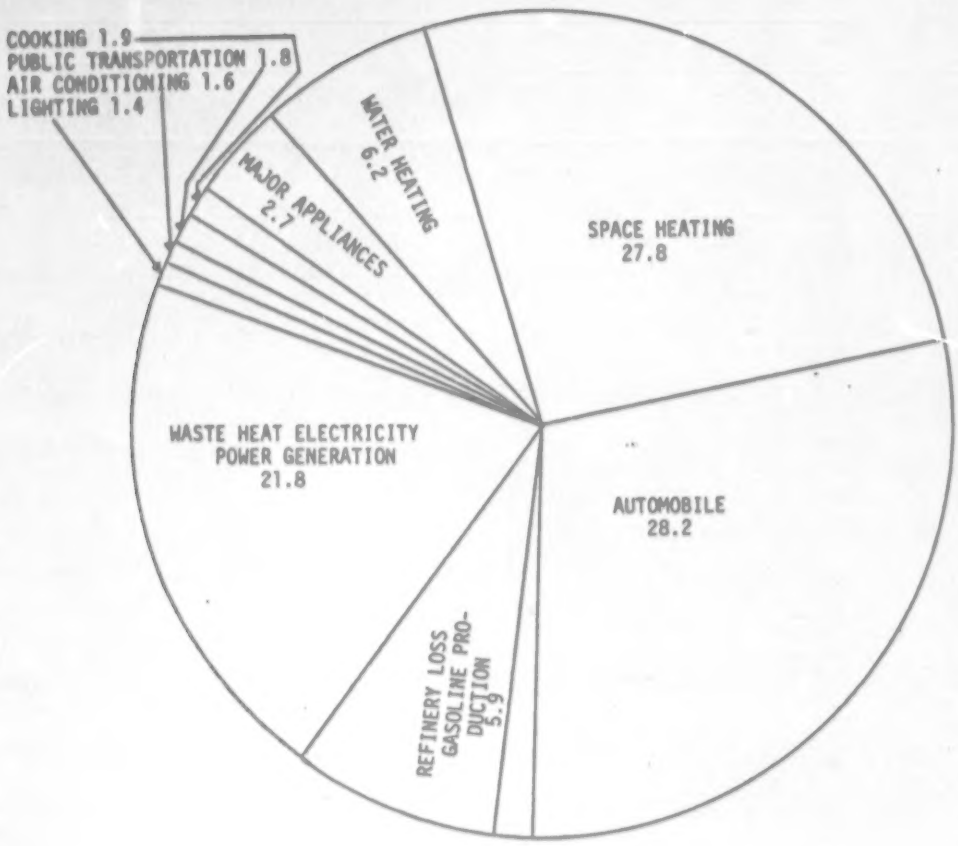
[2]Adapted from Office of Energy Research and Planning, Office of Governor, State of Oregon, 1973.

NEED	SOME MEANS OF SATISFACTION
Residential Shelter	Furniture, Lighting, Appliances, Heating, Cooling, Water Supply Landscaping
Organizations	Government, Political, Financial, Labor, Service, Special Interest Groups, Professional, Social, Legal
Creativity and Recreation	Sports, Entertainment, Toys, Pets, Arts and Crafts, Alcohol and Drugs
Food and Beverages	Meats, Vegetables, Dairy, Fruits, Grains, Bakeries, Soft Drinks, Alcohol
Communications	Telephone, Radio, TV, Books, Talk, Magazines, Postal
Physical Protection	Police, Fire, Military, Health, Drugs
Apparel and Grooming	Cosmetics, Clothing, Hair and Body Care
Curiosity and Knowledge	Schools, Libraries, Museums
Spiritual	Place of Worship, Retreat or Meditation
Birth and Death	Maternity, Babywear, Funeral Parlors
Mobility	Cars, Buses, Airplanes, Highways

What we must realize in looking at these needs is that everyone does not require the same goods and services and corresponding amounts of energy to satisfy their needs. Individual needs differ depending on the climate of the region and on the dictates of one's cultural environment. This cultural environment includes the individual's ethnic or religious affiliations, urban or rural influences, and the socio-economic level of the individual or family group.

All of these factors contribute to the definition of an individual's lifestyle. Considered in the aggregate sense these lifestyle requirements can have very different impacts on our energy resources. An aggregate of high-energy lifestyle requirements may exceed the limits of tolerance of our natural systems as well as deplete the available energy sources. On the other hand, an aggregate of individual lifestyles that reflect an energy-conserving point of view are more sensitive to the environment's limits of tolerance and the danger of resource depletion.

Available figures on the distribution of energy consumption in the residential sector show that the two largest energy uses are for space heating (27.8%) and for automobile operation (28.2%). Other household energy expenditures are accounted for in the following diagram:



Most of these energy expenditures are direct uses of energy, that is, the energy products such as fuel or electricity are directly consumed by the individual household. The above chart reflects the direct energy requirements for household maintenance, that is, the energy needed to satisfy the human need for residential shelter. Another direct energy product which is not included in the chart is the gasoline used for private transportation. This accounts for a large percentage of energy consumption end use as shown on the following list. The five individual activities that involve direct personal use of energy are starred (**).

[3]Citizen Action Guide to Energy Conservation, Citizens' Advisory Committee on Environmental Quality, Washington, DC, 1973.

Direct Energy Uses that Account for More than 1% of U.S. Energy Consumption[4]

Use	Percentage
**Private automobiles	13.8
**Home heating	10.4
Primary metals industry	6.8
Chemical industry	6.3
Trucks (all uses)	5.3
Petroleum refining	3.9
**Residential hot water	2.7
Defense*	2.6
Agriculture (direct fuel use only)	2.0
Natural gas lost and wasted	1.9
Air passenger traffic	1.7
Food processing industry	1.7
Paper products industry	1.7
Public (non-defense government and public institutions)	1.7
Stone, clay, glass and concrete industry	1.6
**Home refrigeration	1.1
**Home cooking	1.0
TOTAL	66.2

*Note: Defense use is calculated on the basis of 1960 data.

In addition to this direct use of energy products, individual households also consume indirect energy products: that is, energy products delivered by systems that require direct energy for their production. For example, the energy "cost" of an appliance is not only the electricity necessary to operate it but also the energy required to make it available--the manufacturing and delivery costs. All the means of satisfying the human needs listed on p. 170 involve these indirect energy costs: the food we eat is produced and delivered by other sectors, such as agriculture and transportation, which use direct energy to do this.

[4]Steinhart, Carol and Steinhart, John. Energy: Sources, Use, and Role in Human Affairs. North Scituate, MA: Duxbury Press, 1974, p. 234.

The way in which individuals satisfy their needs--what they buy--is a reflection not only of lifestyle but also of income--their ability to purchase goods. As we will see in the following section, the higher the income, the greater the indirect energy consumption.

(2) Income

In order to compute the impact of the individual household on the energy resource base, it is necessary to look at the total cost of a lifestyle--both the direct and indirect energy expenditures. Herendeen has compared these two types of energy demands as a function of income[5] and has shown that indirect energy usage increases as the income level rises.

He states that direct energy product usage levels off at the $10,000 income level. At the highest income levels, direct energy accounts for only about 1/3 of the energy use total, whereas at the lowest income levels it reflects 2/3 of the total energy consumption. Herendeen finds the major contributions to the growth of indirect energy come from housing and clothing, transportation besides the automobile, recreation, and investments.[6]

Thus, we can see that energy-conserving measures that are aimed at the direct energy use of the more affluent will, in fact, miss the major portion (2/3)

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[5] Herendeen, R. A. "Affluence and Energy Demand," Mechanical Engineering, October, 1974, p. 18-22.

[6] Source: Office of Science and Technology, Executive Office of the President, Patterns of Energy Consumption in the United States (Washington, DC, 1972).

of their energy consumption impact.

The following table illustrates different facets of this energy consumption pattern. Table One offers an image of direct and indirect energy usage across a seven-level income span[7] for the State of Oregon. The consumption pattern varies from state to state.

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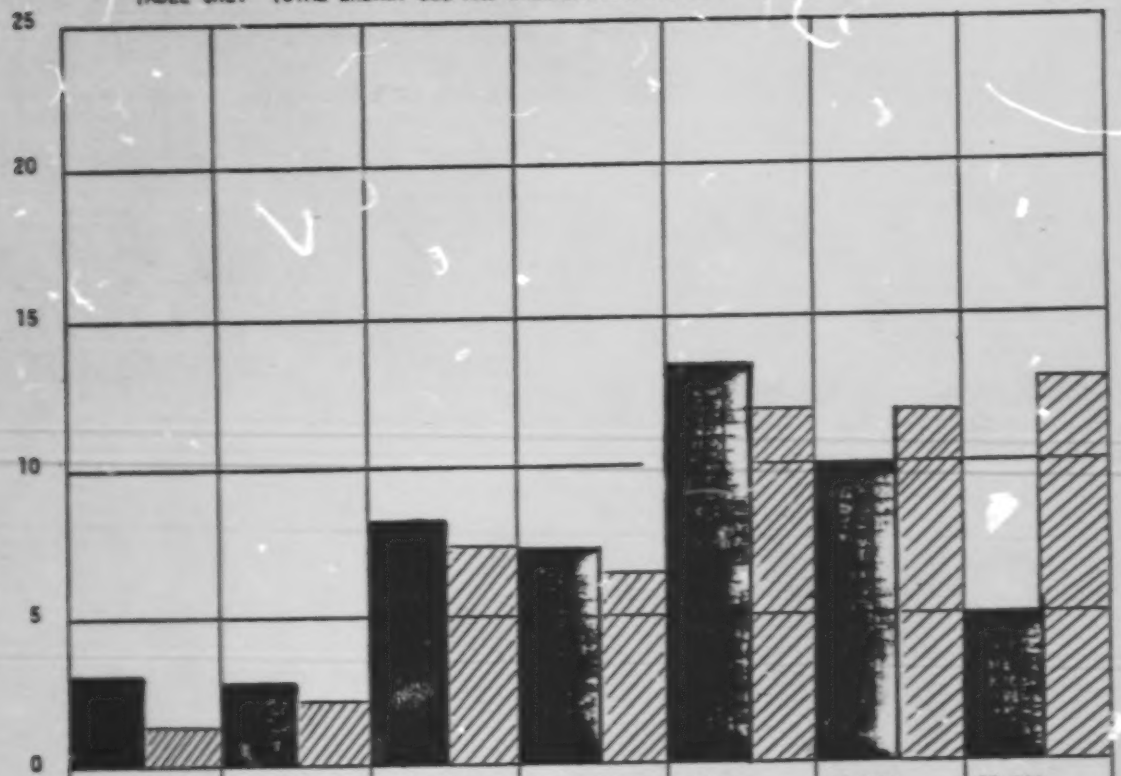
[7] Office of Energy Research and Planning, Office of the Governor, State of Oregon, Transition, Portland: Prometheus Unbound, Speciality Books, 1975.

TABLE ONE. TOTAL ENERGY USE AND INCOME DISTRIBUTION - OREGON 1973



$0 - 2,000	3,000-4,999	5,000-7,999	8,000-9,999	10,000-14,999	15,000-24,999	25,000 above
14% Households	9% Households	22% Households	15% Households	21% Households	13% Households	6% Households
4% T.E.C.*	4% T.E.C.	15% T.E.C.	14% T.E.C.	24% T.E.C.	21% T.E.C.	18% T.E.C.

*Total Energy Consumption

■ = DIRECT ENERGY ▨ = INDIRECT ENERGY

The three middle income groups, which constitute 58% of Oregon households, devote approximately the same proportion of their income to direct/indirect purchases. As income increases, however, the indirect energy expenditures increase rapidly. The reverse is true at the opposite end of the spectrum.

ACTIVITIES

FACILITATING NOTES

ACTIVITY I & II:

(1) Teachers should read pp. 169-176. Prior to completing the activities discuss:

- The "basic needs" chart (p. 170) You may have questions or want to make additions.
- Household direct energy products used (chart p. 173). Make certain you understand the direct/ indirect energy product distinction (chart p. 176).

(2) The activities are intended to help teachers begin thinking about potential targets for energy conservation measures and some possible lifestyles consequences. It is <u>not</u> intended as a policy-forming discussion at this point.

OBJECTIVE: (k) Understand the relationship between income and indirect energy usage.

READING: Hannon, Bruce. "Energy Conservation and the Consumer," Science, Vol. 189, July 11, 1975, p. 95-102.

TO DO:

1. What percent of total energy use does the U. S. consumer control (directly and indirectly) through the purchase of goods and services?

2. How does direct and indirect energy use vary with income?

3. What would be the most effective way to conserve energy for each of the following income levels:

   a. $4,000/year?

   b. $12,000/year?

   c. $50,000/year?

4. Which of these income classes provide the most fertile area for energy conservation?

5. Which income level will be most affected by a direct energy use tax?

6. Which income level will be most affected by a tax based on the amount of energy embodied in a purchase?

ACTIVITY II

OBJECTIVE: (1) Recognize potential areas for conservation at the individual household level.

TO DO: Complete an assessment of the energy-intensive nature of your individual lifestyle by calculating the approximate energy expenditures in each of the following areas: food and beverages, housing, clothing and personal care, transportation and social and governmental services.*

Make some initial recommendations for energy conservation in your own lifestyle.

*This assessment process is based on the Lifestyle Index-77 by Anne Pierotti and Albert J. Fritsch, Center for Science in the Public Interest, Washington, DC, 1976. Publication available from Citizens' Energy Project, 1413 K St., N.W., Washington, DC 20009, $2.00 prepaid.

Use the following lists to see which items "eat up" your food energy units.* Indicate the annual EU expenditure for each area.** Note: You may have to adjust the EU amount to fit your own consumption pattern, e.g., if you use refillable glass bottles every other day, add 12 EU instead of 24.

1. FOOD AND BEVERAGES (Energy needed to produce, process, and deliver these products):

		APPROX. ANNUAL
MEAT:	.75 EU/lb.	MEAT _____
POULTRY:	.50 EU/lb.	POULTRY _____
FISH:	.72 EU/lb.	FISH _____
DAIRY:		DAIRY _____
cheese	.80 EU/lb.	FRUITS _____
milk	.19 EU/qt.	
eggs	.72 EU/doz.	GRAIN _____
FRUITS:		VEGETABLES _____
oranges	.21 EU/lb.	TV DINNER _____
other	.12 EU/lb.	
VEGETABLES:	.25 EU/lb.	EAT OUT _____
GRAIN:		PETS _____
flour	.15 EU/lb.	CONTAINERS _____
rice	.32 EU/lb.	
cereal	.54 EU/lb.	TOTAL _____
TV DINNER:	.59 EU/lb.	

EAT OUT: Allow 1 EU per dollar spent on eating out

PETS: Multiply the number of pounds of pet food meat used per week by 50 EU and the number of pounds of pet food cereal by 12 EU.

CONTAINERS: For each 12-ounce can or bottle used daily the following yearly EU expenditure must be added:

refillable glass bottles	24 EU
non-returnable glass bottles	71 EU
bimetallic cans (steel and aluminum)	57 EU
aluminum cans	96 EU

*These figures are from Energy and Food by Anne Pierotti, Andrew G. Keeler, and Albert J. Fritsch, Center for Science in the Public Interest, Washington, DC, 1977.

**If you figure the "family total" of EU expenditures, divide this figure by the number of household members to obtain the individual total.

2. Housing

OPERATING COSTS:

Use your utility bill to record the total number of kilowatt hours of electricity, cubic feet of natural gas, and/or gallons of fuel oil you used during the year.

Now find the corresponding number of energy units using the Energy Use Chart. Estimate for in-between values. Record in the next column. Total your energy use in EU's and divide by the number of users in your household. Only 73% should be credited to housing, so multiply by .73.

Electricity _____KWH = _____EU
Natural gas _____Cubic Ft. = _____EU
Fuel Oil _____Gallons = _____EU

Total = _____EU

Total Operating Costs: _____

Divide this total by the number of occupants in your household.

Energy Use Chart

Electricity		Natural Gas		Gasoline & Fuel Oil	
KWH	EU	Cubic Feet	EU	Gallons	EU
100	36.8	1000	38.0	10	45.0
200	73.6	2000	76.0	20	90.0
300	110.4	3000	114.0	30	135.0
400	147.2	4000	152.0	40	180.0
500	184.0	5000	190.0	50	225.0
600	220.8	6000	228.0	60	270.0
700	257.6	7000	266.0	70	315.0
800	294.4	8000	304.0	80	360.0
900	331.2	9000	342.0	90	405.0
1000	368.0	10000	380.0	100	450.0
2000	736.0	11000	418.0	200	900.0

RESIDENCE: (Home construction expenditures allotted over a 25 year span)

Check your type of home dwelling	Your EU Rating
_____Single dwelling house (1480)	EU _____
_____Two to four unit apartment building (1126)	EU _____
_____Five plus unit apartment building (1207)	EU _____
_____Public housing building (1228)	EU _____

TOTAL RESIDENCE _____

Divide this total by the number of occupants in your household.

HOME IMPROVEMENTS

	If You Spent	Your EU Rating
Home additions and alterations	100	110 EU
	500	550 EU
Estimate the $ you spent this year	1000	1100 EU
	1500	1650 EU
	2000	2200 EU

TOTAL HOME IMPROVEMENTS _____

$ _____ Divide total by number of household occupants.

RESIDENCE FURNISHINGS

Furniture	If Your Spent	Your EU Rating
Estimate the $ you spent this year	10	0.5 EU
	20	1 EU
	100	5 EU
	500	25 EU
$_____	1000	50 EU

TOTAL FURNISHINGS _____

Divide total by number of household occupants.

NONDURABLES (Tissues, brooms, etc.)
AND OTHER DURABLES (Fans, lamps, carpets, etc.)

	If You Spent	Your EU Rating
Estimate the $ you spent this year	10	1.5 EU
	20	3.0 EU
	30	4.5 EU
	40	6.0 EU
	50	7.5 EU
	100	15.0 EU
$_____	500	75.0 EU

TOTAL NONDURABLES _____

Divide total by number of household occupants.

TOTAL HOUSING

_____

3. Clothing and Personal Care

CLOTHING

Estimate the $ spent on personal clothing	For each $ spent give yourself 1 EU
$_____	_____EU

TOTAL CLOTHING _____

PRODUCTS

Manufacturing, merchandising, and transporting is part of the overall "cover charge." Following are some EU expenditures for average yearly use:

clothing	179 EU	____
sewing machine	2 EU	____
yarns	16 EU	____
laundry appliances	13 EU	____
soaps	38 EU	____
toilet articles	27 EU	____
sanitary supplies	32.5 EU	____
drugs	40 EU	____
tobacco (per smoker)	89 EU	____
tobacco supplies (per smoker)	8 EU	____
matches	5.5 EU	____
jewelry	7.5 EU	____
costume jewelry	4.5 EU	____
paper products	16.5 EU	____

TOTAL PRODUCTS _____

TOTAL _____

4. Transportation

GASOLINE CONSUMPTION

Use chart below to figure the direct fuel cost of your automobile.

Record here miles/gal.	Record here average miles/month	Your EU Rating (match the proper row and column)
_____	_____	_____

Multiply your month EU Rating by 12 _____

TOTAL GASOLINE CONSUMPTION _____

CALCULATIONS FOR DIRECT ENERGY USE OF AUTOMOBILE: GASOLINE ONLY

	10 mi	50 mi	100 mi	200 mi	500 mi
10 mpg	1.00 gal 4.5 EU	5.0 gal 22.4 EU	10.0 gal 45.0 EU	20.0 gal 90.0 EU	50.0 gal 224.5 EU
12 mpg	0.8 gal 3.6 EU	4.2 gal 18.9 EU	8.3 gal 37.4 EU	16.6 gal 74.7 EU	41.7 gal 187.6 EU
14 mpg	0.71 gal 3.2 EU	3.6 gal 16.2 EU	7.1 gal 32.0 EU	14.3 gal 64.3 EU	35.7 gal 160.6 EU
16 mpg	0.63 gal 2.8 EU	3.1 gal 14.0 EU	6.3 gal 28.4 EU	12.5 gal 56.2 EU	31.2 gal 140.4 EU
18 mpg	0.55 gal 2.5 EU	2.8 gal 12.6 EU	5.6 gal 25.2 EU	11.1 gal 50.0 EU	27.8 gal 125.1 EU
20 mpg	0.5 gal 2.2 EU	2.5 gal 11.2 EU	5.0 gal 22.5 EU	10.0 gal 45.0 EU	25.0 gal 112.5 EU
22 mpg	0.45 gal 2.0 EU	2.3 gal 10.4 EU	4.5 gal 20.2 EU	9.1 gal 41.0 EU	22.7 gal 102.2 EU
24 mpg	0.41 gal 1.8 EU	2.1 gal 9.4 EU	4.2 gal 18.9 EU	8.3 gal 37.4 EU	20.8 gal 93.6 EU
VW (26 mpg)	0.38 gal 1.7 EU	1.9 gal 8.6 EU	3.8 gal 34.7 EU	7.7 gal 24.7 EU	19.2 gal 86.5 EU
30 mpg	0.31 gal 1.3 EU	1.5 gal 6.8 EU	3.1 gal 9.2 EU	6.3 gal 16.8 EU	15.7 gal 70.8 EU

MANUFACTURING/RETAIL

Record here vehicle weight in pounds	Your Pound Share	Your EU Rating
_____	100	15.4
	200	30.8
	500	77.0
	1000	154.0
	2000	308.0

Divide by the number of users to determine your pound share

TOTAL MANUFACTURING ____

OTHER TRANSPORTATION

This chart helps you to determine other transportation costs. Your mileage use of each form of transportation gives you extra EU's. Circle each one that might apply to you, then add them up and record.

If you travelled:

Miles	Train	Highway Bus	Urban Mass Transit	Aircraft	Cruise Liner	Yacht	Bicycle
100	9.4	4.2	28	30	48	140	.6
200	18.8	8.4	48	60	96	280	3.2
300	28.2	12.6	42	90	144	420	4.8
400	37.6	16.8	56	120	192	560	6.4
500	47.0	21.0	70	150	240	700	8.0
1000	94.0	42.0	140	300	480	1400	16.0
2000	188.0	84.0	280	600	960	2800	32.0

TOTAL "OTHER" _____

TOTAL TRANSPORTATION _____

5. Social and Governmental Services

PRIVATE SERVICES:

Check if you use any of these		Per person average (multiply by 2 for heavy use, divide by 2 for light use)	
1. Finance, Insurance, Real Estate		36 EU	_____
2. Personal Finance		15 EU	_____
3. Legal Services		14 EU	_____
4. Medical and Educational Services		344 EU	_____
5. Non-profit services (includes religious)		45 EU	_____
6. Recreation/Travel		30 EU	_____
7. Advertising		34 EU	_____
8. Auto Repairs		72 EU	_____
9. Personal Care:	Laundries	18 EU	_____
	Beauty Shop	8 EU	_____

TOTAL PRIVATE SERVICES _____

PUBLIC SERVICES:

Construction and maintenance of: hospitals, education facilities, public utilities, highways, sewage systems, and water systems.

TOTAL PUBLIC SERVICES (per person) 411.8 EU

GOVERNMENT SERVICES:

Defense, transportation, construction, freight and commerce.

TOTAL GOVERNMENT SERVICES (per person) 667.2 EU

COMMUNICATIONS:

Telephone, radio, TV	52.5 EU	_____
Postal service	40 EU	_____
Newspapers	81 EU	_____
Books	28 EU	_____

TOTAL COMMUNICATIONS _____

TOTAL _____

TOTAL FOOD/BEVERAGES	_____
TOTAL HOUSING	_____
TOTAL CLOTHING/PERSONAL CARE	_____
TOTAL TRANSPORTATION	_____
TOTAL SOCIAL/GOVERNMENT SERVICES	_____
TOTAL ENERGY	_____

Compare individual energy profiles of group members: correlate direct and indirect energy use with income.

Based on your assessment profile, LIST SOME SPECIFIC ENERGY CONSERVATION RECOMMENDATIONS relevant to your energy consumption patterns.

FOOD/BEVERAGES:

HOUSING:

CLOTHING/PERSONAL CARE:

TRANSPORTATION:

SOCIAL/GOVERNMENT SERVICES:

b. Institutional Level

Human activities at the institutional level, as they are currently organized and monitored, in many cases work toward the detriment of energy-conserving resource utilization policies and practices. Institutional barriers vary in kind and degree and it is the purpose of this section to understand their contradictory and/or counterproductive effects.

(1) Economics

One of the strongest institutional forces is that of economics. According to Schumacher, "Economics play a central role in shaping the activities of the modern world, inasmuch as economics supplies the criteria of what is 'uneconomic,' and there is no other set of criteria that exercise a greater influence over the actions of individuals and groups as well as over governments."[8] Economics, as it has been traditionally defined by those in the profession is the study of the allocation of scarce resources.[9] A new definition is needed, however, in order for economics to respond to the currents of institutional and social change--particularly as they concern energy use. The reality

[8]Schumacher, E. F. Small is Beautiful: Economics as if People Mattered. New York: Harper & Row, 1973.

[9]Biniek, Joseph P. "An Enlarged Concept of Efficiency" in Appendix to Hearings before the Subcommittee on Energy and Power, Part 3, Middle- and Long-term Energy Policies and Alternatives, Washington, DC: U.S. Government Printing Office, 1976, p. 108.

of our energy dilemma is apparent: we are a nation which "has allowed itself in nearly every facet of its life to be locked into a finite energy supply which is now running out."[10]

This realization has prompted economists and policy makers to re-examine the current state of our economy and the resource utilization practices and policies sanctioned by our traditional economic paradigm. As Arthur F. Burns, former Chairman of the Federal Reserve Board, noted in July, 1971: "The rules of economics are not working quite the way they used to."[11]

Part of the difficulty with traditional economic methodologies is their inability to consider human and environmental costs in their equations. Insistence on applying a strict monetary standard of value on our resource base excludes consideration of the very real social and environmental costs of maintaining a high-energy society. Alternative proposals have adopted an energy standard of value as a basis for economic development decisions[12] and recognize the full costs that our activities are imposing on society--including costs to the environment.[13]

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[10] Appendix to Hearings, p. 5.

[11] Henderson, Hazel. "Ecologists versus Economists," Harvard Business Review, July-August, 1973.

[12] Hannon, Bruce M. "An Energy Standard of Value," Annals of the American Academy of Political and Social Science, November, 1973, p. 139-153.

[13] Stone, Christopher D. Should Trees Have Standing? Toward Legal Rights for Natural Objects. Los Altos, CA: William Kaufmann, Inc., 1974, p. 27.

In his book Small is Beautiful: Economics as if People Mattered, Schumacher attacks the narrow evaluative standard as providing only part of the picture required for sound economic policy:

> "The judgment of economics is an extremely fragmentary judgment; out of the large number of aspects which in real life have to be seen and judged together before a decision can be taken, economics supplies only one--whether a thing yields a money profit to those who undertake it or not."[14]

Schumacher points out that this traditional viewpoint is inappropriate in our current cultural context because:

- it gives more weight to the short than the long term
- it is based on a definition of cost which excludes all "free goods,"--that is, the resources of our environment
- it deals with goods in accordance with their market value and not with what they really are, that is, it doesn't consider their origin or the conditions under which they have been produced.

The concern of Schumacher and others[15] about the limitations and shortcomings inherent in our present economic model stems from an increasing awareness of the need to question the most basic concepts underlying traditional economic thought...economic growth.

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[14]Schumacher, p. 42.

[15]For a collection of essays focusing on "the widespread reassessment of economic doctrines, particularly as they concern energy use", see Appendix to Hearings before the Subcommittee on Energy and Power, Part 3, Middle- and Long-term Energy Policies and Practices, 1976, available from the U.S. Government Printing Office, Washington, DC, $3.10.

> "Except for some isolated voices in the last few years, economists have always suffered from 'growthmania'. Economic systems as well as economic plans have always been evaluated only in relation to their ability to sustain a great rate of economic growth."[16]

Unlimited growth is no longer an appropriate model from a thermodynamic and ecological point of view. Continued economic growth, like physical growth, becomes impossible after a point.

> "We find, therefore, that the idea of unlimited economic growth, more and more. until everybody is saturated with wealth, needs to be seriously questioned on at least two counts: the availability of basic resources and, alternatively or additionally, the capacity to cope with the degree of interference implied."[17]

What new concepts, then, can form the basis of a "new" economic strategy, one that does not ignore the social and environmental realities? The readings at the end of this section examine two such "new" economic models in terms of their lifestyle implications and their consistency with the ideals of the Stewardship Worldview.

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[16]Georgescu-Roegen, Nicholas. "Energy and Economic Myths--Part 1" in Appendix to Hearings, p. 313.

[17]Schumacher, E. F. Small is Beautiful, p. 30.

(2) Political and Legal Institutions

The political and legal aspects of energy conserving resource utilization refer primarily to the monitoring and regulation of resource utilization practices. Our attention will be focused on those government policies regarding resource utilization that often cost the taxpayer dearly and exact a terrible toll on the environment. Why, in fact, can't we restructure our government institutions to address present needs instead of past conditions? This section looks at some of the political and legal aspects of implementing energy-conserving resource utilization practices.

The authority for resource development resides in three agencies: the Department of the Interior (oil, coal, and gas leasing), the Atomic Energy Commission (nuclear development), and the Federal Power Commission (electricity and gas). It is now the responsibility of the recently created Department of Energy to coordinate the efforts of these agencies whose domination by the primary energy industries is openly acknowledged.[18]

The list of "inappropriate" political practices with respect to energy resource conservation is long. James Moorman cites the following:

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[18]Clark, Wilson. "Renewable Energy Sources and a Conservation Economy: A Future Survey," June, 1977 (unpublished paper).

> "Our twenty-thousand-man Forest Service now lets million-acre, fifty-year concessions to industry. Our Interior Department wrecks the salmon resources of the Pacific Northwest with dams to make electricity to make aluminum beer cans. Our Soil Conservation Service has become an agency which promotes the destruction of free-flowing streams. In brief, our solutions were administrative and bureaucratic and they have turned on us and bitten us."[19]

Some of the more apparent transgressions and abuses have occurred through government investments, subsidies, and incentives encouraging the development of new energy supplies, relaxation of regulations where they conflict with needed short-term energy supplies and revision of water and mineral rights to spur economic development.[20]

Not only are many of current governmental programs working against energy-conserving resource utilization, but plans for the future--as indicated by research and development efforts--reflect an attitude or orientation which helps account for our present energy problems. For example, despite the fact that electricity is by far the most expensive form of energy and so far has facilitated the depletion of high-energy non-renewable resources and inefficiencies connected with excessive centralization, more than 75% of the fiscal 1978 federal research budget is devoted to new

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[19]Moorman, James. "The Future of Environmental Law" in Progress as if Survival Mattered, (Hugh Nash, ed.). San Francisco: Friends of the Earth, 1977, p. 286.

[20]Davies, III, Clarence J.; and Davies, Barbara S. The Politics of Pollution (2nd Edition). Indianapolis: Bobbs-Merrill Co., Inc., 1975.

sources of electricity.[21] Other R&D efforts on fuel sources are devoted to coal-leased synthetic fuels, while in the area of solar energy, the emphasis is on large-scale, centralized systems for producing electricity.

Our response to the waste and inefficiency inherent in many of our current and proposed governmental programs is usually one of public outrage followed by some type of investigation or lengthy litigation procedure. At best, governmental response is remedial, legislating short-term solutions to meet the demands for action. It is these short-term solutions which have aggravated further energy-conserving resource utilization practices.

Governmental response to pollution illustrates this double bind well. Since the mid-fifties, the basic framework for pollution control legislation has been "in the process" of evolution. The manner in which interest groups such as electric utilities, oil companies, and automobile manufacturers have influenced pollution control legislation is analyzed in a book entitled The Politics of Pollution.[22] The primary weaknesses in most of the legislation dealing with clean air and water are:

- a failure to utilize regional approaches to those problems which ignore traditional political jurisdictions

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[21] Hammond, Allen L. "'Soft Technology' Energy Debate: Limits to Growth Revisited?" Science, Vol. 196, May 27, 1977, pp. 959-961.

[22] Davies, III, Clarence J.; and Davies, Barbara S. The Politics of Pollution (2nd Edition). Indianapolis: Bobbs-Merrill Co., Inc., 1975.

- a failure to set standards to achieve environmental quality and to define uniform, national, or state standards for individual sources of pollution
- the nature of enforcement of state and federal standards
- the failure to place the burden of costs of pollution on those doing the polluting

The pollution control technologies which were developed and implemented to meet government requirements reflect some serious counterproductive energy-conserving resource utilization goals and practices. The pollution control devices themselves often cost a great deal--in both energy and dollars. High quality energy, in the form of sophisticated technology, is being used to eliminate pollutants and other undesirable waste products. For example, the disposal of waste heat from power plants is a major source of water pollution. The pollution control technology designed to eliminate this problem is the "cooling tower." These cooling towers, however, in addition to requiring massive capital expenditure, millions of gallons of water a day, and energy-intensive monitoring procedures, <u>also</u> pose additional environmental problems by transferring heat to the atmosphere which is not an effective cooling agent. Thus, we have the situation of trying to cope with a pollution disposal problem by expending "high quality" energy (technology) that further depletes the resource base.

A second example of a short-term governmental solution which further aggravates energy-conserving resource utilization is the use of antipollution devices on automobiles. Again, the cost--especially with respect to the limited benefits--is high. Wilson Clark cites the following "side effects" of using catalytic converter antipollution devices:[23]

1. Platinum and other catalyst materials are imported--one more critical resource is added to the import list.
2. Catalytic converters emit tiny metallic particles which may pose a health problem
3. Catalytic converters penalize the gas mileage of automobiles

Government, then, in attempting to be responsive to environmental problems, sometimes overlooks the very real energy costs of implementing its "protection programs." And yet government regulations and legal processes are important tools for promoting energy-conserving resource utilization practices. It seems, however, that neither has provided adequate creative leadership in dealing with the problems of resource utilization.

The readings that follow present some political and legal strategies that would attempt to implement more effective long-term resource conservation practices.

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[23]Clark, Wilson. Energy for Survival, p. 112.

ACTIVITIES

FACILITATING NOTES

Activity III & IV:

Institutional Level

(1) Teachers may recommend other readings on economics. Such readings, if included, should reflect the objectives; that is, contribute to an understanding of both the traditional and the "new" economic models as they relate to energy-conserving resource utilization.

(2) In the political/legal section, the readings are, for the most part, of a general nature. Christopher Stone in Should Trees Have Standing? cites some more specific recommendations for legal operations as well as an example of a Supreme Court opinion (Part II). Even though this resource was used in a previous section (Stewardship Worldview), it is a good idea to re-examine it here.

(3) Teachers may be able to supply current local examples of institutional involvement or citizen-based initiatives that deal with energy resource utilization issues. Such concerns could form the basis for (or possibly replace) ACTIVITY IV on p. 207. The purpose of making this personal contact with a community organization is to begin evaluating "energy position statements "holistically." The exercise can be done by the group as a whole or by 2 or 3 teachers together. Set up this contact before starting these activities to ensure enough lead time for arrangements to be made.

OBJECTIVES:

(m) Be able to characterize some "new" economic models

(n) Understand some of the legal and political impediments to implementing an energy-conserving resource utilization policy.

TO DO:

1. Each teacher completes one reading and set of questions for each category--economics and political/legal aspects.

2. Use group discussion to compare the two "new" economic strategies and to exchange information on local organizations concerned with energy policy questions.

3. Based on a group discussion, each teacher selects a second reading--from those listed here or one recommended by a group member--that involves energy-related human activities at the institutional level.

ECONOMICS
READING I:

Boulding, Kenneth E. "The Economics of the Coming Spaceship Earth," in Toward a Steady-State Economy (Herman E. Daly, Ed.). San Francisco: W. H. Freeman and Co., 1973, pp. 121-132 (especially pp. 127-132).

QUESTIONS:

1. Characterize Boulding's "cowboy economy" and "spaceman economy."

2. What are some "new" economic principles Boulding advocates for Spaceship Earth?

ECONOMICS

READING II: Schumacher, E. F. Small is Beautiful: Economics as if People Mattered. New York: Harper & Row, Pub., 1973.*
Chapter 3, "The Role of Economics," pp. 40-52.
Chapter 4, "Buddhist Economics," pp. 53-63.

QUESTIONS:

1. In the religion of economics, how does "behaving economically" promote non-responsibility in buyer and seller? (pp. 44-45)

2. How does the method of cost/benefit analysis lead to deception and false valuing? (pp. 45-46)

3. How would the concept of "meta-economics" include the notion of quality as well as that of quantity? (pp. 46-52) What distinctions between "goods" does it make? (pp. 49-50)

4. Characterize the features of "Buddhist economics" in terms of labor/work; goods; consumption; imports/exports; natural resources.

5. How does the path of "Right Livelihood" compare to the basic tenets of the stewardship worldview? (See Section 2, p. 46)

*The chapter "Buddhist Economics" also appears in Herman Daly, Ed., Toward a Steady-State Economy, 1973, pp. 231-239.

POLITICAL/LEGAL
READING I:

Wheeler, Harvey. "The Politics of Ecology" in Politics and Ecology, (Philip O. Foss, Ed.). Belmont, CA: Duxbury Press, 1972, pp. 34-39.

QUESTIONS:

1. How does the "new politics of ecology" differ from conservationist politics?

2. What does Wheeler claim is the "real revolution implicit in the politics of ecology"?

3. Wheeler lists some ecological questions that will need to be addressed by the politics of the future. What kind of political system does he recognize as being capable of addressing these concerns?

POLITICAL/LEGAL READING II: Moorman, James. "Getting the Government to Obey its Own Laws" in Progress as if Survival Mattered, pp. 294-299.

QUESTIONS:

1. List some ways statutory mandates are sidestepped or ignored by governmental agencies who find them inconvenient (pp. 294-296).

2. What are some procedural techniques the government uses to avoid review? (p. 297).

POLITICAL/LEGAL
READING III:

Satin, Mark. New Age Politics: Healing Self and Society, 1978, pp. 5-20; 44-58.

QUESTIONS:

1. What are the aspects of a "transformed world" that New Age politics seeks to address?

2. What do New Age thinkers cite as the two definitive political choices that every society must make?

3. What are some of our cultural impediments that need to be addressed personally and politically (i.e., the Prison)?

4. How are monolithic institutions and technologies impediments to resolution of our "problems of success"?

5. What are the characteristics of "monolithic technology? How do they compare with the basic tenets of a stewardship approach to resource utilization?

TO DO:

1. Contact a local non-government organization (or a branch of a regional or national organization) that is active on the political/legal scene with respect to ecology/ energy issues.

2. Find out what is now, and has previously been, its major focus with respect to energy policy questions.

    - Has it proposed or actively supported any ballot initiatives?
    - Has it been involved in any litigation regarding energy issues?
    - What is its position with respect to government role--legislative and judicial effectiveness; resource conservation; individual lifestyles?

3. Request some of its publications and bring them to share with the group. Does it have any community outreach or education programs with respect to energy issues?

4. How does this organiztion fit into the "new politics of ecology"?

    - Is it futures-oriented, engaged in long-range planning?
    - Does it address social questions regarding values, lifestyle, personal consumption?

5. How comprehensive or holistic is its approach? Does it recognize the interrelatedness of questions of environment economics, energy and lifestyle?

The written text, readings and activities of the INQUIRY were organized and presented for the purpose of providing you with a knowledge base about a stewardship approach to energy-conserving resource utilization. It would be useful now to review as a group the goals stated at the beginning of the INQUIRY before proceeding to the INTEGRATION.*

As a group, have you covered the material comprehensively enough to understand the following:

(1) How the current energy resource problem is related to our past dreams and successes?

(2) How energy "experts" map the energy conservation territory?

(3) How attitudes and values contribute to resource utilization policies and practices?

(4) How certain resource utilization strategies reflect the stewardship worldview?

(5) Natural systems structure and processes?

(6) The role of natural systems in energy supply and demand?

(7) The energy requirements of individual households?

(8) Some institutional barriers to implementing energy-conserving resource utilization policies and practices?

*See Objectives (1) through (8) of the Goals and Objectives Chart at the beginning of the INQUIRY, p. 8.

INTEGRATION presents two skills development activities which can help the teacher analyze potential energy conservation strategies and recommend specific measures for implementation in a given community.

INTEGRATION

INTEGRATION

In the INQUIRY you were exposed to the important concepts and principles associated with the environmental problem area of Energy-Conserving Resource Utilization. You were introduced to the notion of a stewardship worldview which could be basic to both individual energy consumption practices and to institutional policies concerning energy resource utilization.

This INTEGRATION further explores these concepts in a problem-solving format that allows you to: (1) develop critical skills with respect to energy conservation policies and practices, and (2) to make specific energy conservation recommendations for a given community.

After completing the INTEGRATION you will be able to:

(E) Apply energy-conserving criteria to individual lifestyle decisions.

1. To complete this activity your group should have available copies of the following documents:

   Executive Office of the President, Energy Policy and Planning, The National Energy Plan. Washington, D.C.: U.S. Government Printing Office, April 29, 1977.

   Office of Technology Assessment (OTA), Analysis of the Proposed National Energy Plan. Washington, D.C.: U.S. Government Printing Office: August, 1977.

   Citizens' Advisory Committee on Environmental Quality, Citizen Action Guide to Energy Conservation, 1700 Pennsylvania Ave., N.W., Washington, D.C. 20006.

2. Decide together which Office of Technology Assessment "Issues" will be explored by each teacher to ensure a balanced discussion for evaluating the Plan.

3. It is expected that the second part of the INTEGRATION, the actual proposal and consideration of conservation measures, will require the bulk of the group's time. Consideration of the National Energy Plan and OTA's analysis are intended to provide a critical framework for group exploration of energy conservation and the individual life style.

4. Estimated time to complete the INTEGRATION is 10-12 hours.

The Module's Goals and Objectives Chart follows. Only those goals relevant to information presented in the INTEGRATION are highlighted.

MODULE GOALS AND OBJECT

I. Develop teachers' awareness and understanding of the environmental problem area of Energy-Conserving Resource Utilization.

B

Develop teachers' understanding of the stewardship approach to resource utilization.

3.
Understand how attitudes and values contribute to resource utilization policies and practices.

4.
Understand certain resource utilization strategies which reflect the Stewardship Worldview.

c.
Be able to characterize some past and present aggregate worldviews.

d.
Understand the attitudes and values that contribute to the evolution of a Stewardship Worldview.

e.
Be able to characterize three sample resource utilization strategies.

C

Develop teachers' understanding of the natural systems role in energy-conserving resource utilization.

5.
Understand natural systems structure and processes.

6.
Understand the role of natural systems in terms of energy supply and demand.

f.
Understand the major cycles and processes of our biophysical life support system.

g.
Understand the principles of energetics.

h.
Understand availability of energy resources and the environmental advantages and disadvantages of their development.

i.
Understand energy resource delivery stages.

j.
Understand the extent to which recycling and resource recovery can conserve energy resources.

D

Develop teachers' skills in assessing and comparing various energy-conserving measures.

7.
Understand the energy requirements of individual households.

8.
Understand some of the institutional barriers to implementing energy-conserving resource utilization policies and practices.

k.
Understand the relationship between income and indirect energy usage.

l.
Recognize potential areas for conservation at the individual household level.

m.
Be able to characterize some "new" economic models.

n.
Understand some of the legal and political impediments to implementing an energy-conserving resource utilization policy.

INQUIRY SECTIONS 2 & 3

INQUIRY SECTIONS 4 & 5

INQUIRY SECTION 6

ALS AND OBJECTIVES

d under-
lem area of
tion.

F: To facilitate teachers' developing class-room instructional materials on the utilization of energy-conserving resources.

D

Develop teachers' skills in assessing and comparing various energy-conserving measures.

7.
Understand the energy requirements of individual households.

8.
Understand some of the institutional barriers to implementing energy-conserving resource utilization policies and practices.

k.
Understand the relationship between income and indirect energy usage.

l.
Recognize potential areas for conservation at the individual household level.

m.
Be able to characterize some "new" economic models.

n.
Understand some of the legal and political impediments to implementing an energy-conserving resource utilization policy.

E

Apply energy-conserving criteria to individual lifestyle decisions.

9.
Apply the knowledge base acquired in the inquiry toward the assessment of a proposed conservation strategy and the recommendation of specific energy-conserving measures for a community.

o.
Apply critical skills for the holistic evaluation of an energy conservation strategy.

p.
Devise an aggregate-level energy conservation plan that includes potential barriers to implementation.

F

To familiarize teachers with the components of an environmental problem or issue and to develop experience in planning holistic environmental education for students.

10.
Be familiar with the basic characteristics of an environmental problem or issue.

11.
Plan instructional activities for students on Energy-Conserving Resource Utilization by applying a set of guideline criteria.

q.
List major topics, concepts, principles and processes associated with an environmental problem and display them in a contextual map.

r.
Complete a checklist for planning environmental instructional units or lessons.

INQUIRY SECTION

INTEGRATION SECTION

APPLICATION SECTION

After completing the INTEGRATION you will be able to:

(o) Apply critical skills for the holistic evaluation of an energy conservation strategy.

(p) Devise an aggregate-level energy conservation plan that includes potential barriers to implementation.

Part One of this activity deals with the National Energy Plan. It offers a perspective on national energy concerns, priorities and conservation recommendations. Using this plan and its subsequent analysis by the national Office of Technology Assessment involves you in the critical task of assessing proposed conservation measures. Your expertise as developed in the INQUIRY will assist you here in examining and commenting on both the plan and the analysis.

Part Two addresses the individual's role in energy conservation and asks the group to act as a Task Force for a specific community--determine what measures could be proposed to reduce individual energy consumption by 50% in the areas of transportation and residential space heating.

PART ONE: ENERGY CONSERVATION AND THE NATIONAL ENERGY PLAN

OBJECTIVE:	(o)	Develop teachers' critical skills for the holistic evaluation of an energy conservation strategy.

1. Each teacher reads the following section of The National Energy Plan:

   - Overview pp. VII to XIV
   - Chapter IV: Conservation and Energy Efficiency, pp. 35-47.

   Make notes as to the specific energy-conserving measures cited in this document, i.e., carpooling, fuel efficiency taxes and rebates, mass transit by bus and rail, etc. Include, if possible, which resources would be conserved by each of these measures.

2. Each teacher reads pp. 88-125 of the Analysis of the Proposed National Energy Plan which comments on various aspects of the Energy Plan via "Issue" statements. Each teacher selects at least three of these sixteen "Issues" to summarize for the group. To do this, compare the "Issue" analysis to the Plan and consider the questions asked by the analyst. Do they seem realistic and well-founded? Include any additional comments you might have concerning either the plan or its analysis.

3. As a group, review the conservation measures proposed in the National Energy Plan. (It may be helpful to compile a "master" list of these.) Having considered the Office of Technology Assessment's Analysis, complete, as a group, an "evaluation" of the proposed measures by applying the following questions to each measure

ENERGY-CONSERVING RESOURCE UTILIZATION

EVALUATION OF PROPOSED CONSERVATION MEASURES

ENERGY CONSERVATION RECOMMENDATIONS						
(1)	(2)	(3)	(4)	(5)	(6)	(7)

① List proposed conservation measures

② Answer the questions

	EVALUATION
What percentage of present total energy expenditure does this savings amount to?	Is the total percentage savings substantial? (Over 20%) ___YES ___NO
What income brackets would be most affected?	Do these recommendations promote equitable access to resources and primary means of production? ___YES ___NO
Is the savings in direct or indirect energy use?	Are both direct and indirect savings included? ___YES ___NO
What type(s) of energy resources are required?	Is dependence on fossil fuel resources alleviated? ___YES ___NO
	Are any "alternative" fuel sources recommended? ___YES ___NO
Is "soft" or "hard" technology required for production?	Is the technology used "appropriate" to the end use product? ___YES ___NO
Is the primary energy source available through a centralized or decentralized energy supply system?	Will the measures promote any decentralization of energy supply and delivery? ___YES ___NO

How many transportation steps to "deliver" this item?

Does the consumer require more or fewer energy-intensive products as a result of this saving?

Does the consumer require more or fewer labor-intensive products as a result of this saving?

What type of solid waste is produced?

What type of environmental pollutants are associated with processing, delivery, and waste disposal for this measure?

What, if any, are the dollar savings of this measure?

What consumer "sacrifices" are required?

Are any delivery system stages simplified or eliminated?

___YES ___NO

Are the "costs" associated with energy-intensive, labor-intensive products reduced?

___YES ___NO

Are any waste materials recovered or recycled?

___YES ___NO

Will the environmental quality of air, water or land resources be improved?

___YES ___NO

Does the total dollar savings represent a significant amount?

___YES ___NO

Do these measures as a whole allow us to maintain our current standard of living?

___YES ___NO

What type of lifestyle change will they require?

___drastic
___considerable
___minimal

FACILITATING NOTES

ESTIMATED TIME FOR COMPLETION: 10-12 hours

1. Descriptive characteristics of a community other than those mentioned can be included by the group in its local profile. They should be pertinent to the problem-solving task, however.

2. The group may want to split up to discuss the implementation of individual measures: each sub-group prepares a plan for one or two of the measures. This may cut down some redundancy in having to assess each of the measures.

3. The suggested reading Citizens' Action Guide to Energy Conservation is available from the Citizens' Advisory Committee on Environmental Quality, 1700 Pennsylvania Ave., N.W., Washington, DC 20006, $175/copy. However, if this publication is not acquired, one or more substitutions must be made. Some possibilities include the following:

   - Center for Science in the Public Interest, 99 Ways to a Simple Lifestyle, Bloomington, IN: Indiana State University Press, 1976.

   - Seidel, Marquis R.; Plotkin, Steven E.; and Reck, Robert O. Energy Conservation Strategies, U. S. Environmental Protection Agency, Washington, DC, 1973.*

   - The Potential for Energy Conservation, prepared by the Executive Office of the President, Office of Emergency Preparedness, Washington, DC, 1972.*

   - "Making the Most of Your Energy Dollars," U. S. Department of Commerce, National Bureau of Standards, Washington, DC, 1975.*

   - Hirst, Eric; and Moyers, John C. "Efficiency of Energy Use in the United States," Science, Vol. 179, March 30, 1973, pp. 1299-1304.

   - Lincoln, G. A. "Energy Conservation," Science, Vol. 180, April 13, 1973, pp. 155-161.

   - Hirst, Eric. "Transportation Energy Conservation Policies," Science, Vol. 192, April 2, 1978, pp. 15-192.

   - Spies, Henry R.; Konzo, Seichi; Calvin, Jean; and Thoms, Wayne. 350 Ways to Save Energy (and Money) in Your Home and Car. New York: Crown Publishers, Inc., 1974.

*Available from Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

ENERGY CONSERVATION AND THE INDIVIDUAL HOUSEHOLD

OBJECTIVE:	(p)	Devise an aggregate-level energy conservation plan that includes potential barriers to implementation.

GIVEN: The present household energy budget spends 30% of its energy on transportation and 27.8% on space heating. This totals 57.8% of total household energy use.

PROBLEM: How to revise the pattern of energy use to achieve a 50% savings in these two areas for each household?

This activity will focus on the group's ability to recommend specific energy-conserving measures that could effect this significant energy savings for all households in a given community.

It is important that the community be described by the group prior to completing the reading or recommending strategies. The physical, geographical, and cultural dimensions of the "place" will affect the proposed measures.

The group's conservation plan for the individual householders in Community X will be developed keeping in mind the assessment criteria presented in Part One. Additionally, as part of the Recommendation Report, the group will note possible implications/effects of implementing this plan.

1. Teachers specify the characteristics of the community. Keep in mind the following:

   - geographical location for climate considerations
   - size and number of inhabitants, i.e., urban or rural
   - nature of industry, employment, i.e., income of community
   - type of housing
   - nature of transportation systems

2. Each teacher reads Citizen Action Guide to Energy Conservation, pp. 8-35. Based on this reading, the National Energy Plan and the previous readings in the Inquiry Section, make some preliminary notes on possible energy-conserving measures for this community.

3. As a group, compare recommendations and discuss the feasibility and potential savings of each. Use the assessment criteria of Part One as a guideline for evaluating the holistic nature of the measure.

4. Compile an Energy Conservation Recommendation Report addressed to the mayor or city manager of this community that includes:

   a. Recommendations for the individual householder to conserve energy in the area of transportation.

   b. Recommendations for the individual householder to conserve energy in the area of space heating.

   c. The anticipated energy savings (in % or BTU's) for each measure.

   d. A brief rationale or explanation of each measure.

   e. A list of some possible implications of implementing this plan in the community and the group's recommendations for ensuring the success of the plan. Some questions to consider would be:

      - What current government policies, practices, or codes may prove to be barriers?
      - What kinds of incentives, if any, could be considered for each measure?
      - Which special interest groups will be opposed to or support the various measures?
      - What do you anticipate will be the attitude(s) of the community (groups/individuals) toward the proposed measures?
      - What kind of educational/informational activities will be required?

Before proceeding with the APPLICATION, it may be useful to review, as a group, the goals and objectives for the INQUIRY and INTEGRATION.

As a group, have you covered the material comprehensively enough to:

- Develop an understanding of energy resource utilization as one of your "problems of success"?
- Develop an understanding of the stewardship approach to resource utilization?
- Develop an understanding of the natural systems' role in energy-conserving resource utilization?
- Develop skills in assessing and comparing various energy-conserving measures?
- Apply energy-conserving criteria to individual lifestyle decisions?

APPLICATION presents a set of guidelines for planning and implementing instructional programs on Energy-Conserving Resource Utilication.

APPLICATION

1. Estimated time to complete the APPLICATION is 10-12 hours.

2. You should begin by reading through the entire APPLICATION (the Appendices are optional).

3. If the group feels the need to agree upon a definition of environmental education (EE) before beginning the instructional planning process, you can start by reviewing the definition provided in the module's PREFACE, page xiii. You should be aware that EE can also be thought of as:

    - the study of everything--nature, humankind, all disciplines and fields of knowledge;
    - the study of human beings' interaction with nature (the biosphere);
    - the study of the relationships between nature and human systems; and
    - the study of reciprocal or optimal ways to manage the relationships between natural and human systems.

4. "Warm up" to the planning process by discussing and selecting some aspects of Energy-Conserving Resource Utilization which interest you and might interest your students. Consider how the environmental problem issue of resource utilization relates to your own professional subject area. For example, you might start the planning task by identifying Conservation/Utilization topics, concepts, and principles which are compatible with your subject area; the possibilities might include: the history of energy resource problems, people's current attitudes and values, the structure of natural systems, the role of institutions, etc.

5. Keep in mind that, when planning the student learning activities, the ultimate goal of the instructional plan is to develop in students a level of awareness and understanding regarding our utilization of energy-conserving resources that approaches the level you and the other teachers achieved after completing the INQUIRY and INTEGRATION materials.

6. You can begin planning an environmental instructional unit or lesson for your students by using:

    - the contextual map you developed in the Activity; and
    - the checklist to ensure the adequacy of your instructional plan.

7. Remember, you can utilize the planning checklist in any one of the three ways recommended on p. 244.

8. You can create a unit plan in one of the following ways (whichever is the most comfortable for you):

   - Work individually at first; then share and refine your ideas and plans in a group discussion.
   - Work with another person at first, then share and refine your ideas and plans in a whole group discussion.
   - Work in a whole group to develop a common plan which each teacher can live with and carry out in his/her classroom.

   You should find these group discussions most helpful in: (a) sharing ideas and suggestions, and (b) developing a common set of "notes" which can be used subsequently to select specific instructional materials from or to develop more detailed, classroom-ready environmental, energy-focused activities for your students.

9. You should set a specific time limit (1 week, 3 weeks, 6 weeks, etc.) for your unit--even though this time limit may be changed later--since doing so will help provide you with some concrete limits within which to plan student learning experiences.

10. Remember to specify a particular setting (local, state, regional, etc.) and problem focus in which you might want your students to examine energy-conserving topics, concepts, and principles.

11. If you and the other teachers have developed individual instructional plans, go over them in a group discussion and compare them with the guidelines in the checklist. In particular, you should make certain that your plans are specific regarding:

    - the problem context--including topics, concepts, processes that will be covered or utilized (Note: these should address at least some of the topic-and process-oriented contents identified on p. 235.
    - instructional aims or learning objectives;
    - learning resources (readings, people, exercises/activities);
    - evaluation criteria and procedures;
    - time schedule or sequence for learning activities.

12. Do not avoid this planning activity on the basis of your intention or desire to later explore with your students some energy-conserving problem/topic areas compatible with their interests. You will find that your initial planning efforts, though tentative, will pay off by better helping you to prepare for implementing environmental education in your classroom.

The Module's Goals and Objectives Chart follows. Only those goals and objectives relevant to information presented in the APPLICATION are highlighted.

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FOR FILMING DUE TO POOR REPRODUCIBILITY.

APPLICATION

This APPLICATION provides you with an opportunity to plan an environmental instructional unit(s) or lesson(s) for classroom use which are holistic, transdisciplinary, and issue-focused. The APPLICATION, then, constitutes an exercise in designing a learning experience or set of experiences which raises students' levels of awareness and understanding of Energy-Conserving Resource Utilization.

The APPLICATION in two sections presents:

The Environmental Problem Context--this section describes the general characteristics of an environmental problem or issue as the primary focus for an instructional unit or lesson.

Checklist for Planning Environmental/Energy-Focused Instructional Units or Lessons--this section presents guideline questions for planning and developing environmental problem-focused instructional materials and activities.

After completing the APPLICATION section, you should:

(F) Have a familiarity with the components of an environmental problem or issue context, and experience in planning holistic environmental education instruction and learning for students.

SECTION 1

THE ENVIRONMENTAL PROBLEM CONTEXT

After completing this section, you should:

(10) Be familiar with the basic characteristics of an environmental issue context.

Before beginning the instructional planning process, it is useful to examine those aspects of an environmental, energy-focused problem context considered by curriculum designers to be suitable for increasing students' broad understanding of energy and environmental problems and issues.

An environmental problem context which is suitable or appropriate for students must involve the following:

a. An issue of national priority

b. A setting of environmental interest

c. Topic/process oriented content

d. A contextual map

A MAJOR GOAL OF ENVIRONMENTAL EDUCATION IS TO DEVELOP IN LEARNERS AN AWARENESS AND BROAD UNDERSTANDING OF ISSUES OF NATIONAL PRIORITY

a. An issue of national priority represents a major environmental issue or problem which is or should be of concern to our national, state, and local leaders...and to citizens in general. Such an issue is broad in impact and complex in nature. Resolution of the issue involves an ongoing process of making and changing policies, regulations, and legislation, and of altering personal values and lifestyles.

In general, an environmental, energy-focused issue of national priority arises from what might be called the "new scarcity" which reflects our approaching the finite planetary limits of: fossil fuels and strategic minerals; natural fresh water; food-productive, arable land; habitable surface area; waste-absorptive capacity of the natural environment; and resilience of the planet's life-support ecosystems.

Examples of issues of national priority which address these "new scarcity" areas are:

- energy resource delivery and use
- energy conserving resource utilization
- optimal use of finite land resources
- energy-intensive urban growth and the quality of life

A MAJOR CONCERN OF ENVIRONMENTAL EDUCATION IS TO DEVELOP IN LEARNERS AN UNDERSTANDING OF ISSUES OF NATIONAL PRIORITY AS THEY OCCUR IN A VARIETY OF SETTINGS.

b. A setting of environmental interest provides a milieu or frame of reference for focusing on and setting boundaries for the study of an environmental or energy issue of national priority. This setting can be specified in a variety of ways according to:

(1) Natural systems boundaries

- Aquasphere (oceans, lakes, rivers, streams, marshes, aquifers, etc.)
- Lithosphere (mountains, plains, forests, woodlands, deserts, etc.)
- Atmosphere (rainfall, winds, temperatures, sunlight, etc.)

(2) Human systems boundaries[1]

- Shelters (housing, community facilities, city centers)
- Networks (public utility systems, transportation systems, communication systems)
- Individual (physiological needs, safety and security, affection, belonging, esteem, self-actualization, knowledge, aesthetics)
- Society (government systems, legal systems, economic systems, political systems, cultural patterns, population trends, health and welfare systems)

(3) Geographical-political boundaries

- Local, county level of focus
- Multi-county, state level of focus

[1]Adapted from Ekistics, Vol. 41, No. 246, May, 1976, pp. 257-262.

- Multi-state, regional level of focus
- National level of focus
- International, global level of focus

An example of an issue of national priority specified in terms of a setting of environmental interest is: the impact of proposed coal mining operations on the Tri-County Region (geographical-political setting).

c. Topic and process areas provide important focus points for selecting and organizing learning resources to study environmental and energy issues of national priority within specific settings.

> A CENTRAL CONCERN OF ENVIRONMENTAL EDUCATION IS TO DEVELOP IN LEARNERS AN UNDERSTANDING OF THE IMPACTS AND INTERRELATIONSHIPS OF VARIOUS TOPIC AREAS AS THEY ADDRESS ISSUES OF NATIONAL PRIORITY OCCURING IN SPECIFIC SETTINGS.

(1) Key topics provide the learner with a variety of convenient areas for studying an environmental/energy issue of national priority. These areas are so interrelated with respect to environmental issues in general that an entry investigation of one area leads, in most cases, to an investigation of the others as well.[1]

The key topic areas include:

TOPIC ORIENTED

- Population dynamics
- Pollution
- Resource allocation and depletion
- Conservation
- Transportation
- Technology
- Urban and rural planning
- Environmental quality
- Ecological balance
- Natural resource related careers and vocations
- Economic and technological development
- Environmental ethics

[1] All but the last three of these have been designated by the Environmental Education Act, Public Law 91-516 (as amended by P. L. 93-278) as areas of major importance in environmental education. The last three have been added by the developers of this module.

A MAJOR CONCEPN OF ENVIRONMENTAL EDUCATION IS TO DEVELOP IN LEARNERS AN UNDERSTANDING OF AND FACILITY IN APPLYING PROCESSES IN STUDYING ISSUES OF NATIONAL PRIORITY WITHIN SPECIFIED SETTINGS.

(2) Key processes provide the learner with useful conceptual and analytic entry points for studying any issue of national priority in any setting. These processes do not conflict with, but instead complement, the topic oriented entry points specified previously.

The key processes include:

PROCESS ORIENTED

- Analytical or conceptual tools for understanding energy and environmental systems
- Problem-solving and decision-making strategies
- Holistic lifestyle assessment
- Fundamental concepts and principles of energy (energetics)
- Energy delivery systems and processes
- Forecasting, planning, and policy formation
- Futures thinking

Examples of topic and process oriented content which might be studied in the example situation of investigating the impact of coal mining on the Tri-County Region (setting) are:

TOPIC ORIENTED CONTENT

Projected population growth and increased demands for resources (population dynamics, resource allocation and depletion)

Increased pollution and long term environmental health problems (pollution, environmental quality)

PROCESS ORIENTED CONTENT

Carrying capacity analysis as a basic for decision-making (problem-solving and decision-making strategies)

Net energy costs and benefits involved in coal mining operations (energy delivery systems and processes).

YOU SHOULD NOW BE FAMILIAR WITH THE BASIC CHARACTERISTICS OF AN ENVIRONMENTAL, ENERGY-FOCUSED PROBLEM CONTEXT--SPECIFICALLY ADDRESSING:

- AN ISSUE OF NATIONAL PRIORITY
- A SETTING OF ENVIRONMENTAL INTEREST
- TOPIC/PROCESS ORIENTED CONTENT

In the section which follows, the problem context becomes the basis for your planning an environmental, energy-focused instructional unit(s) or lesson(s) for your students.

d. The Contextual Map

To facilitate a broad and comprehensive understanding of the energy conservation territory that is consistent with the holistic view of environmental education as specified by the Environmental Education Act, we have designed a visual and conceptual aid referred to as a contextual map. This map not only identifies the key concepts and relevant topic areas in the energy conservation territory but also demonstrates their relationships. It ensures that the problem area is presented in terms of both natural and human systems considerations as well as the interactions between the systems. A brief description of the organization of this map follows:

The contextual map organizes the module content into:

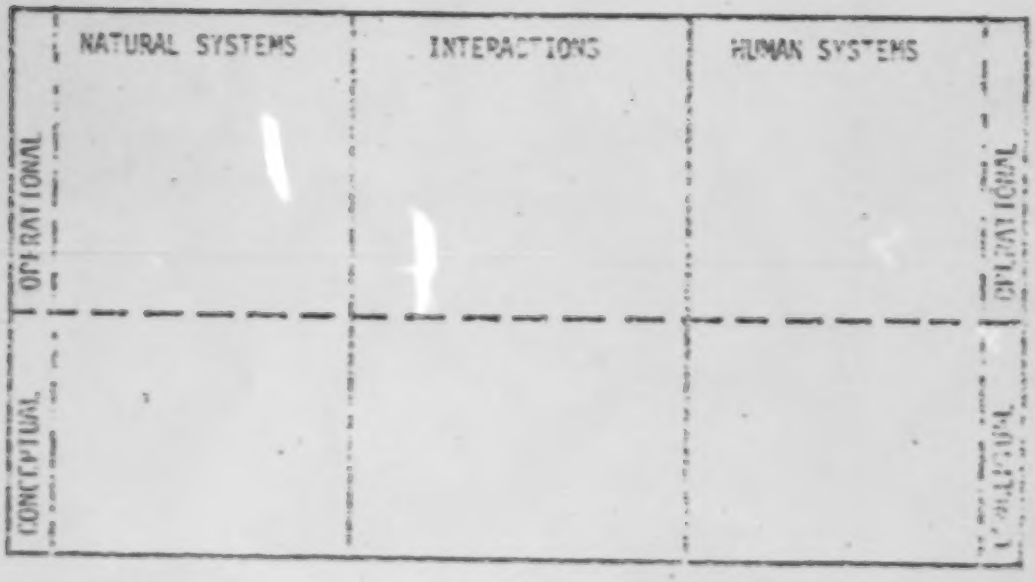
- content dealing primarily with NATURAL SYSTEMS;
- content dealing primarily with HUMAN SYSTEMS: and,
- content dealing with the INTERACTIONS between these two systems.

These major sectors are drawn as follows:

NATURAL SYSTEMS	INTERACTIONS	HUMAN SYSTEMS

The map further organizes the module content into:

- content dealing primarily with CONCEPTUAL aspects (emphasizing ideas, theories, principles, and laws); and,
- content dealing primarily with OPERATIONAL aspects (processes, functions, and applications of concepts).



The map (Figure 1), which follows, briefly describes each sector, indicates important concepts and principles which make up the energy conservation territory we explore in this module and where each of these is located.

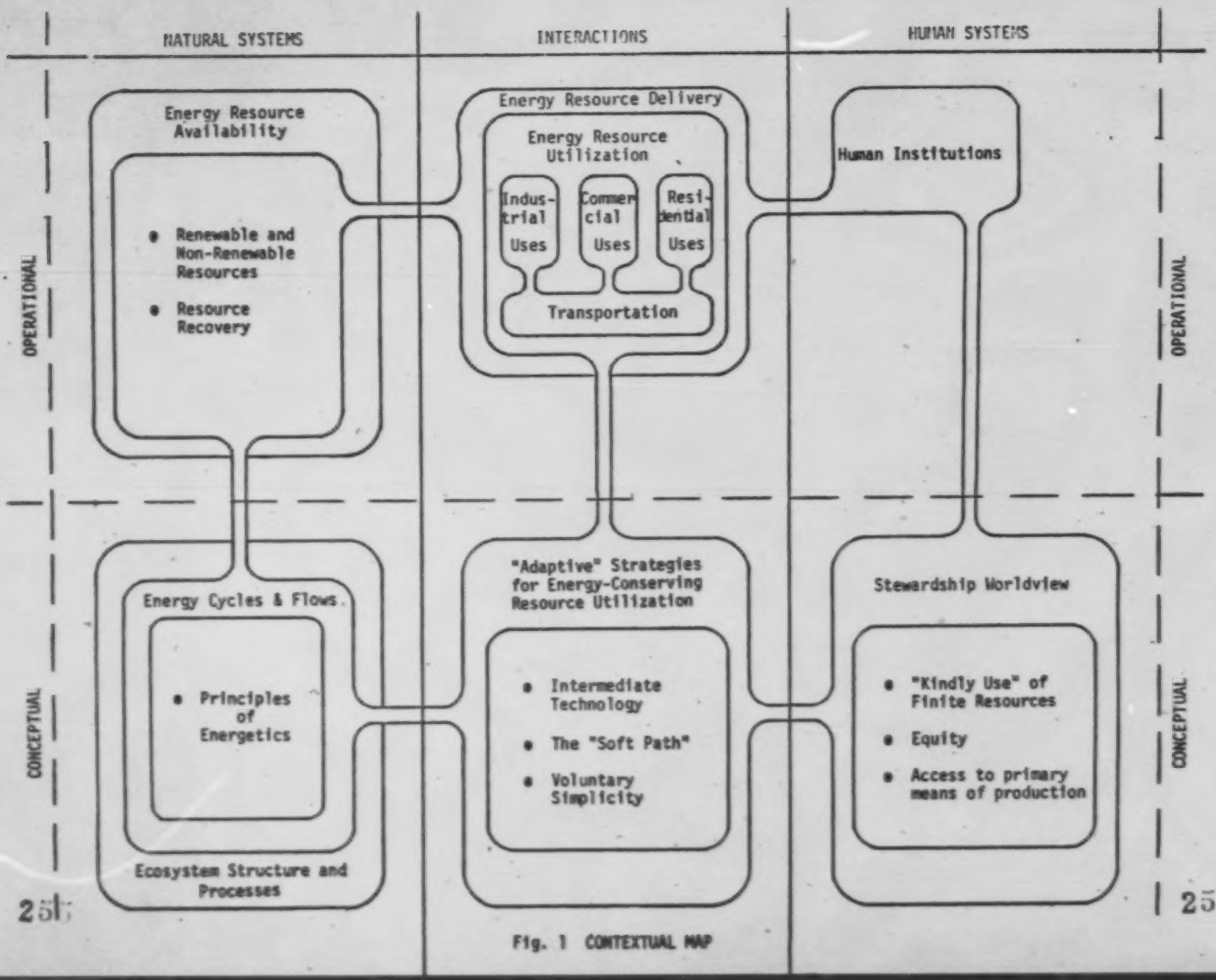


Fig. 1 CONTEXTUAL MAP

CONTEXTUAL MAP: ENERGY CONSERVING RESOURCE UTILIZATION

The satisfaction of human needs through the utilization of natural resources is an interactive process. This Contextual Map indicates these connections between natural and human systems.

HUMAN SYSTEMS CONCEPTUAL: This sector portrays the philosophical orientation toward human and natural systems and their interactions. This orientation here means a worldview or those core beliefs that are reflected in the attitudes and values manifested in human behavior. This sector presents an image of a STEWARDSHIP WORLDVIEW which identifies beliefs and values in harmony with energy-conserving resource utilization characterized by a "kindly use" attitude toward our planet's resources, ...taking into consideration the physical constraints of resource availability. Also projected here is an ideal of equity which would permit individual access to primary resources, goods and services.

INTERACTIONS CONCEPTUAL: This sector describes various ADAPTIVE STRATEGIES which seek to implement energy-conserving resource utilization. These strategies reflect the beliefs of the Stewardship Worldview and consider the natural system structure and process of our energy resources.

NATURAL SYSTEMS CONCEPTUAL: This sector portrays the knowledge base (relative to the natural systems) which has contributed to the definition of a Stewardship Worldview. The STRUCTURE and PROCESSES of the various ecosystems in the biosphere are viewed in terms of their natural system energy cycles and flows. This systemic overview provides additional conceptual support for a Stewardship Worldview aiming at energy-conserving resource utilization.

NATURAL SYSTEMS OPERATIONAL: This sector describes the AVAILABLE ENERGY RESOURCES of the natural systems. It also describes the effects on the various ecosystems of previous and current resource utilization practices in terms of storages, wastes and resource recovery. Such ecosystem accountability is prompted by the "kindly use" attitude toward resource utilization and a desire to promote equity in conjunction with the finite nature of our energy resources.

HUMAN SYSTEMS OPERATIONAL: This sector is the counterpart to the conceptual domain in terms of the way human behaviors and activities are organized to achieve certain ideas or goals. Human system operations are examined at both the INDIVIDUAL HOUSEHOLD and the INSTITUTIONAL LEVELS. The energy requirements of the individual household are examined as well as some ways to organize the economic, political and legal sectors of society for the purpose of achieving energy-conserving resource utilization.

INTERACTIONS OPERATIONAL: In this sector, the means identified in the conceptual sector (i.e., Adaptive Strategies) are combined with the appropriate institutional elements to present an image of the RESOURCE UTILIZATION process and to focus on the sectors of society that could implement energy-conserving resource utilization.

OBJECTIVE: (q)	To list the major topics, concepts, principles and processes associated with an environmental energy problem and display them in a contextual map.

TO DO: 1. Examine the contextual map (Figure 1, p.). Note that the map displays the major topics, concepts, principles, and processes associated with the environmental issue of Energy-Conserving Resource Utilization.

2. Using the general environmental issue of energy conservation, select a specific problem you could present to your students. Think about this problem in terms of:

   (a) aspects involving natural systems, human systems, and the interactions between the two systems;

   (b) major topics, concepts, principles, and processes associated with these aspects.

3. List at least 20 major topics, concepts, principles, and processes associated with your energy conservation problem. Clarify and display these topics, etc. using the contextual map format below:

NATURAL SYSTEMS	INTERACTIONS	HUMAN SYSTEMS

SECTION 2

CHECKLIST FOR PLANNING ENVIRONMENTAL/ ENERGY-FOCUSED INSTRUCTIONAL UNITS OR LESSONS

After completing this section you should:

(11) Be able to plan instructional activities for your students by applying a set of guideline criteria.

This section presents guideline questions for planning and developing environmental/problem-focused instructional materials and activities.

CHECKLIST FOR PLANNING ENVIRONMENTAL/ENERGY-FOCUSED INSTRUCTIONAL UNITS OR LESSONS

Having completed the preceding design activity, you are now ready to develop a tentative plan for an "energy conserving" resource unit or lesson which is compatible with, but not necessarily limited to your subject area, e.g., Social Sciences, Natural Sciences, Humanities, etc. You can develop this plan by using the checklist which follows.

This checklist consists of a series of questions you should address when planning environmental/ energy-focused instructional activities for your students. Successful completion of these questions will help to ensure your developing an effective and instructionally sound unit or lesson plan.

Since the checklist questions are intended only as a guide for your planning task, you are free to address them in any of the following ways:

- you can plan a problem-focused instructional unit or lesson according to your own interests and planning style, and then refer back to the checklist to ensure that your plan is comprehensive.
- you can plan an instructional unit or lesson by answering the checklist questions directly as listed or in any order you choose.
- You can plan an instructional unit or lesson by utilizing both of these approaches, i.e., alternating between the two as your plan develops.

Whichever of these approaches you intend to use, it is strongly recommended that you begin your planning by considering the problem context of the unit or lesson (addressed in checklist question #1) which will be the basis for your entire plan.[1]

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[1] Prior to making your plan you may also want to read Appendix A, Planning Instructional Units or Lessons, for a review of some characteristics of classroom instructional materials, and Appendix B, Developing an Instructional Unit or Lesson Following the Module Format.

CHECK COMPLETED PLANNING AREAS HERE

1. Have you selected an environmental/energy problem context appropriate for your students?

   (a) Have you selected a problem area or issue of national priority or significance? ☐

   What is your problem area or issue?

   (b) Have you determined the level at which your problem has significance? ☐

   - local, county _____
   - multi-county, state _____
   - multi-state, regional _____
   - national _____
   - international, global _____

   Keep in mind that the most important environmental/energy problems have implications or counterparts at all or many of these levels.

(c) Have you characterized the major focus or emphasis of your unit or lesson? (You may prefer to answer Questions d. and e. before completing your answer here). ☐

- Natural systems functions, processes _____
- Human systems functions, processes _____
- Interactions between natural and human systems _____

Keep in mind that a HOLISTIC and INTEGRATED approach to studying the problem area would involve an examination or exploration of the complex interrelationships between natural and human systems rather than focusing exclusively on either.

(d) Have you characterized the various aspects of the problem area which your students are to investigate? (You may prefer to answer Questions d. and e. before completing your answer here). ☐

- physical _____
- social (includes economic, political, legal, etc.) _____
- aesthetic _____
- ethical _____

Keep in mind that a TRANSDISCIPLINARY approach to studying the problem area would involve an examination and synthesis of information from a variety of aspects, disciplines, or points of view.

2. Have you considered how you will introduce the problem issue to your students; how you will interest and motivate them? ☐

Pep talk ____ Movie ____ Guest Speaker ____

Field trip or site visit ____

Student self-directed activity ____

Other _____

3. Have you determined what broad or general questions regarding the problem area you want your students to answer or address? ☐

What are these general questions?

4. Have you identified <u>key</u> topics or sub-topics related to the problem area which your students will cover? ☐

What are these key topics or sub-topics?

5. Have you identified key concepts, principles, and terminology which will be covered? ☐

   What are these key concepts, principles, ideas, and terminology?

6. Have you determined whether or not there are special knowledge or skill prerequisites that your students should have in order to study the problem area? ☐

   What are these prerequisites?

7. Have you decided what learning activities you are planning to use to convey the relevant topics, concepts, principles, etc. to your students? (Example activities might include: tours, field trips, written assignments, lectures, interviews, experiments, special projects, simulations, discussions, etc.).

What are these activities? (Be as specific as possible.)

(You may prefer to answer Question #1 below before completing your answer here.)

(a) Do any of the activities engage your students in PROBLEM-SOLVING or DECISION-MAKING processes with respect to the problem area? _____

(b) Are the activities ones that your students can:

- relate to in terms of their experiences? _____
- complete in the amount of time available? _____

8. Have you identified available resources which your students will need in studying the problem or issue? (Resources might include: readings, films, interviews, reports, etc.) ☐

What are these resources? (Be as specific as possible.)

9. Have you specified student learning objectives for the unit or lesson? ☐

   What are these student learning objectives?

10. Have you determined how you will evaluate whether or not your students have achieved these learning objectives? (Evaluative measures might include: discussion questions, written or oral reports, special task or project assignments, test questions, etc.) ☐

    What are these evaluative measures? (Be as specific as possible.)

11. Have you determined an instructional sequence and schedule for your unit or lesson? ☐

Describe the sequence of activities in as much detail as possible, i.e., describe your lesson plan.

EXAMPLE FORMAT:

Day/ week	Topics/sub-topics to be covered	Key concepts, principles, ideas to be covered	Activities to be used to convey the topics & key concepts

OBJECTIVE: (r)	To complete a checklist for planning environmental instructional units or lessons

TO DO: 1. Now that you are familiar with the characteristics of a problem context and have read over the guidelines for developing an instructional unit or lesson, you can begin the process of planning your own instructional unit, lesson, or program. Remember that your ultimate planning goals are:

- To engage students in learning activities (readings, discussions, exercises, etc.) which address environmental issues or problems, e.g., Energy-Conserving Resource Utilization.
- To raise students' level of awareness and understanding of the issues or problems to a level as near as possible to your own.

2. Start by filling out each of the CHECKLIST items (pp.____) as best you can. Keep in mind that these items are intended to aid you in being as detailed and specific as possible in planning your classroom environmental unit(s) or lesson(s).

3. Feel free to utilize the CHECKLIST in any way you deem helpful. For example, you may decide to: (1) develop an instructional unit or lesson plan on your own, then use the CHECKLIST items to assess the scope and adequacy of your plan; or (2) complete the CHECKLIST first, then reorganize and sequence the information into an instructional plan.

Once you have completed the APPLICATION, you should:

- BE FAMILIAR WITH THE BASIC CHARACTERISTICS OF AN ENVIRONMENTAL/ENERGY PROBLEM OR ISSUE CONTEXT.
- HAVE DEVELOPED A PRELIMINARY PLAN FOR AN ISSUE OR PROBLEM-FOCUSED ENVIRONMENTAL UNIT(S) or LESSON(S) (e.g., ENERGY-CONSERVING RESOURCE UTILIZATION) which can be implemented in your classroom.

APPENDICES

APPENDIX A: PLANNING INSTRUCTIONAL UNITS OR LESSONS

APPENDIX B: DEVELOPING AN INSTRUCTIONAL UNIT OR LESSON FOLLOWING THE MODULE FORMAT

APPENDIX C: INQUIRY ACTIVITY ANSWERS

PLANNING INSTRUCTIONAL UNITS OR LESSONS

A. DISTINCTION BETWEEN A SINGLE CONCEPT AND A MULTIPLE CONCEPT APPROACH

> Question--How does a single concept approach to environmental education differ from a multiple concept approach?

A single concept approach has these characteristics:

- a single concept or skill is treated;
- instructional content is brief, requiring only a few days to complete;
- only a few, highly specific resources are used.

A multiple concept approach has these characteristics:

- several concepts or skills are treated;
- instructional content is longer, containing several concepts, and may take several weeks to complete;
- many resources, both general and specific, are used.

> Question--When should you emphasize a single or multiple concept approach?

The single concept approach should be emphasized:

- when you are dealing with a single, discrete idea or topic area--not a cluster of ideas or skills, or a problem area or theme;
- when your intent is to introduce the learner to a set or series of single concepts, ideas, or skills as preparation for presenting a more complex problem context;
- when an understanding of the overall problem area or context is not, for the moment, of primary importance.

The multiple concept approach should be emphasized:

- when you are dealing with a set of environmental concepts, ideas, or skills which are complex;
- when your intent is to involve students in planning or decision-making on a group or team basis;
- when it is important to present an entire problem context, e.g., the natural, social (including political, economic, legal), aesthetic, and ethical aspects of the selected issue as a necessary background to planning and decision-making;
- when in-depth inquiry and value-development are part of the planning and decision-making application.

These criteria are not hard and fast, but they suggest two instructional possibilities: (a) younger students might benefit more from a single concept approach in order to prepare or ready them for involvement in more complex activities; and (b) a multiple concept approach might better serve secondary school students (grades 10-12) and adults. Intermediate level students, grades 7-9, may benefit from a combination of both approaches.

In the APPLICATION, we emphasize the design of instructional unite or lessons which utilize a multiple concept approach in addressing environmental issues of national importance.

B. CHARACTERISTICS OF INSTRUCTIONAL UNITS OR LESSONS

In planning environmental education instructional units or lessons, consider the following self-directing questions. As you address these questions in your initial planning, you should begin to form a general picture of the features or characteristics of your instructional units or lessons.

1. Student factors

- What is your understanding of your students' degree of preparation or readiness for problem-focused, decision-making oriented learning materials and experiences?

THINGS YOU NEED TO KNOW AHEAD OF TIME

- Is the problem area too sophisticated or complex?
- Are the reading resources (such as those presented in the bibliography of this module) too difficult, too sophisticated?
- Would learning exercises or simulation activities (such as those presented in the Inquiry section) be too difficult, too demanding?
- Would your students be able to work effectively within a group or team learning mode? Will it be necessary to utilize a more individualized learning approach? Some combination of group and individualized learning?

If you are uncertain as to your students' readiness or motivation for these activities, you may wish to assess their preparation with some preliminary learning activities involving:

WAYS YOU CAN FIND OUT

- sample readings addressing the problem context with follow-up class discussions (these may focus on single concepts or single subtopics as expedient);
- small group assignments to explore some specific community resources related to the problem context (e.g., tours, site visits, talks with knowledgeable persons, etc.);
- simplified problem-solving, decision-making, or values clarification exercises focusing on some sub-aspect of the problem issue.

Remember that in assessing your students' readiness, it is not so important to determine how much they know about the problem issue as it is to determine if they will be able to: (a) complete reading and resource exploration assignments, (b) interact and exchange ideas effectively in large or small groups, and (c) utilize problem-solving and decision-making processes required in the learning activities (exercises, simulations, etc.).

2. Teacher factors

- Do you see yourself only, you and another teacher, another teacher only, or a larger teacher team using the instructional materials?
- How much direction, guidelines, or preparatory training will this person or persons require?

WHO WILL USE THE MATERIALS

If you see yourself as the prime or sole user of the instructional materials, you will still need to specify the details of an instructional plan. The specific learning activities and the schedule of events should be specified.

If you are devising the instructional materials for other persons, then very detailed usage steps, timetables, and resource materials will need to be provided in addition to the above.

And with team-devised/team-taught materials, it is suggested that a set of directions be provided so that one person can serve as a team monitor to keep track of instructional variations, new ideas, and changes in procedures, and to monitor and record the entire set of activities.

3. Instructional factors

- What should go into the instructional plans for developing the environmental education units or lessons?

Here are a minimum number of things to consider:

a. Instructional aims--the overall educational reasons or benefits for using the materials.

b. Learning objectives--the general and specific knowledge and skill development objectives, stated in behavioral terms, that is, in terms which are measurable and observable and which specify criteria against which successful performance can be assessed. With student-training materials, the learning objectives should be keyed directly to the steps of the instructional sequence.

c. Resource requirements--the required and optional learning resources for developing students' knowledge and skills. The resources might include films, slides, and other A-V materials, maps, charts, case studies, bibliographies, monographs, periodicals, newspapers, magazine articles, textbooks, paperbacks, tours, lectures, T.V. and radio programs, site visits, agency/organization publications, interviews, field studies, learning games, simulations. These resources can be teacher-prepared, student-devised, or commercially perpared.

d. Learning arrangements--as a rule, student learning arrangements should vary or change during the instructional sequence of units or lessons. Thus, students move through a series of large group, small group, and individual study/discussion/application tasks as required by the instructional sequence. This practice offers the student not merely a "change of pace," but opportunities for escaping either psychologically or physically from the confines of standard classroom pedagogy.

e. Timetables, schedules--multiple-concept, problem-focused instructional units, especially when preceded by shorter, single-concept preparation units, may take several weeks to complete. It is important that time allocations, sequences, and schedules for instructional/learning activities be specified.

f. Information handling and evaluation--within a given unit or lesson, there are a number of useful student evaluation checks which can be built into each step of the instructional sequence, e.g., student reports, discussion worksheets, inquiry and application task checklists, and other evaluative materials. It is necessary, therefore, to indicate the procedures to be used and the forms to be collected at the end of each step. It is also necessary to key the evaluation to the student learning objectives.

g. Options and special activities--there can be many resources and activity options at each step of an instructional sequence. This flexibility should be utilized by teachers to ensure that the learning activities are compatible with the needs, interests, and abilities of students. Therefore, if desired, optional or special learning resources (and activities) can be used.

4. Instructional sequence

- What general steps or tasks need to be specified for an instructional unit or lesson which develops students' knowledge and skills in a selected environmental problem issue?

The instructional sequence or steps can follow any one of a number of formats depending on the intended users. The general format utilized in the present instructional module and a student-oriented variation of it are presented in Table One only as examples:

TABLE ONE

The teacher training module instructional sequence	A possible student lesson instructional sequence
• INQUIRY Knowledge development (utilize problem-relevant resource materials) • INTEGRATION Skill development (utilize problem-focused exercises, simulations) • APPLICATION Student learning unit/ lesson design and development	• INQUIRY Knowledge development (utilize problem-relevant resource materials • INTEGRATION Skill development (utilize problem context-focused exercises, simulations) • APPLICATION?

5. Problem context

- What tasks are necessary to develop the environmental problem context described in Section 1 of the APPLICATION?

In order to develop this problem context to a level which is presentable to students, you will need to do the following:

a. Identify a problem issue which has both national significance and significance at regional, state, or local levels.

b. Select (or develop if necessary) a regional, state, or local level scenario as a frame of reference for studying the problem issue--whichever level is of greater interest or significance to learners.

c. Identify available resources (readings, tours, lectures, films, interviews, etc.) for studying the problem issue at the level (or levels) selected.

When properly developed, the problem context will constitute an effective and comprehensive basis for exploring the environmental problem issue through case studies, simulations, and other learning activities.

DEVELOPING AN INSTRUCTIONAL UNIT OR LESSON FOLLOWING THE MODULE FORMAT

The student instructional sequence presented in Appendix A, Table One will now be utilized to present some basic tasks necessary for developing an environmental/energy-focused instructional unit or lesson similar in format to the one utilized in this teacher-training module. These tasks, when fully elaborated and geared to the students' level of sophistication, can take the form of a user-ready set of student learning materials or a set of instructional guidelines for making topic presentations, problem-focused classroom discussions, student work assignments and skill development exercises, and evaluating students' performance and progress.

Keep in mind that this is an example of only one possible instructional unit or lesson format for your students. If you wish to utilize another format, proceed according to the guideline questions of Section 2 of the APPLICATION.

STEP ONE: INQUIRY--Develops students' knowledge base regarding the selected environmental problem issue by involving them in an in-depth exploration of the problem using relevant learning resources.

1. Describe the environmental problem or issue for the unit or lesson. Tell students why this problem is significant both nationally, locally, regionally, or globally as the case may be. Tell them why you have selected this problem area from other possible ones.

2. Describe the instructional sequence for the unit or lesson, the instructional strategies you will use, and the learning arrangements they will use. Explain the general learning (knowledge and skill) objectives, the general time-line or schedule of events, the resource requirements, and the criteria and methods by which they will be evaluated (or will evaluate themselves).

3. Define all terms which students don't understand.

4. Define or describe the essential questions which must be answered regarding the problem (or have the students do this if they select the problem area). Make certain the problem issue has been adequately specified by defining or describing relevant data resources, concepts, principles, and activities related to the problem area.

5. Organize the resources in several ways to diversify students' possible entries into the knowledge base: (a) organize them according to natural systems, human systems, or the interactions between the two; (b) organize them according to topics (key environmental entities) or process (content/processes) you wish to emphasize; (c) organize them according to the various physical, social (including economic, political, legal), aesthetic, and ethical aspects of the environmental/energy problem issue.

   Teachers can begin the process of selecting and organizing student learning resources by asking themselves (a) which of the topics, sub-topics associated with the subject area, and (b) which learning resources are relevant to both the problem area and to my own subject area.

6. Develop a list of study/discussion questions to guide students in their exploration of the learning resources. Key these questions to the major features or critical points of the environmental/energy problem issue covered by the resources. Use these questions in written assignments or follow-up discussions to assess students' depth of understanding.

STEP TWO: INTEGRATION-- Develops students' skills in applying their knowledge of the environmental problem issue by involving them in policy planning and decision-making activities.

For example, a simulation activity would require you to:

1. Select or prepare a general scenario which describes the environmental problem in a specific setting (local, regional, national, global).

2. Prepare a set of descriptions or guidelines for the students to act as planners, policy-makers, and decision-makers in addressing the problem issue presented in the scenario. Organize students into groups or subcommittees and assign each to explore a different major aspect of the problem in more depth.

3. In order to heighten students' interest in the activity, you may wish to enhance the problem scenario by preparing a set of descriptions or representative articles or documents (e.g., letters of concern) which present the viewpoints and concerns of individuals and groups who might reasonably be affected by or interested in the problem issue. It may be useful to key these concerns to the major physical, social, aesthetic, and ethical aspects of the problem context.

4. Select or prepare a set of data or facts which cover the energy aspects of the problem scenario and which the students can use in their planning, problem-solving, or decision-making task. Prepare any additional information, maps, charts, illustration, etc., which the students may need.

5. Develop a general time-table or schedule for how long each task of the simulation is to last and the order in which tasks are to be carried out.

6. Define all terms and concepts which students don't understand. Clarify any misunderstanding regarding the major aspects of the problem issue, use of resources, or simulation procedures. Hold a post-simulation debriefing with students to summarize their findings, conclusions, and recommendations.

STEP THREE: EVALUATION--Evaluation items may be developed for each step or for the entire unit or lesson.

- INQUIRY evaluation should assess students' overall understanding of the key dimensions or critical aspects of the environmental problem context.

> Key question--Have students acquired the requisite knowledge and level of understanding of the environmental problem?

- INTEGRATION evaluation should assess students' general performance in developing coherent positions or in formulating justifiable policy statements regarding the problem issue.

> Key question--Are students able to utilize their knowledge and understanding in a problem-solving or decision-making task?

Keep in mind that evaluation measures may take one or several of the following forms:

Think/discussion questions

Written and oral reports

Performance assessment of activities, tasks, or special project assignments

Test questions

Appendix C provides example answers to each of the Activities in the INQUIRY. Many of these answers have been devised by teachers and are offered as a basis for comparison only.

INQUIRY ACTIVITY ANSWERS

SECTION I

ACTIVITY I:

1. Falling water; wind; wood; animals; slave labor; coal; petroleum; hydroelectric power; nuclear power;

2. Windmill; waterwheel; steam engine; automobile; electric light; labor-saving devices (home appliances); agricultural mechanization;

3. High productivity; many labor-saving devices; high capital investment; pollution and waste materials from energy use production; significant iron steel technology; centralized power structure; increased mobility; increase in leisure time; personalized transportation; machines performing major portion of physical labor;

4. An example: Machines save labor and increase leisure which is filled by using more energy-intensive machines (e.g., campers, trailbikes, TV, airplanes);

5. Use all you can as fast as you can and then throw it away;

6. a. processed foods; fast food chain; agribusiness energy-intensive machines

   b. individual cars; gasoline credit cards; airlines

   c. telephone; satelline communication

   d. high-rise apartments; campers; vacation homes; air conditioning; swimming pools; labor-saving devices

SECTION I

ACTIVITY II:

POSITION PROFILE #1

	HISTORICAL GROWTH	TECHNICAL FIX	ZERO ENERGY GROWTH
ENERGY SUPPLY FORECAST	Rely on oil and gas until the year 2000; greater dependence on coal and nuclear power; high imports	Conservation allows more flexibility; some development of "unconventional sources"--solar, geothermal, etc.; steady rate expansion of oil and gas; no import increase	Increase development of renewable energy resources and redirect future growth toward smaller scale energy systems
ROLE OF CONSERVATION IN THE ENERGY FUTURE	NONE	Significant--specific measures outlined for residential, commercial, transportation, and industrial sectors to effect direct and indirect energy savings	Same as for Technical Fix--a shift toward energy-conserving devices, with an emphasis on efficiency
GOVERNMENT ROLE IN ENERGY POLICY	Monitor links in the supply chain; provide incentives to enhance development of energy resources; new regulatory legislation	Assist in implementing energy saving features in buildings: revise and update building codes and standards for federal loans; establish regional technical assistance centers	An energy sales tax used for public services; same building restrictions as for Technical Fix. Encourage use of scrap and fund R&D in energy consumption

ACTIVITY II: POSITION PROFILE #1

	FORD FOUNDATION PROJECT POSITION
1. Energy Supply: Fossil Fuels	Some further development: onshore Alaska, offshore Gulf of Mexico, some coal mining, secondary and tertiary recovery of oil and gas from existing wells
2. Energy Growth	Keep it at about 2%
• Alternative Energy Sources	Post 1985: solar, geothermal, solid and organic wastes
• Hard Technology Sources	Some development but restricted, not massive
3. Role of Energy Conservation	Basic to all recommendations by this Project; recommend savings by technical fixes in building construction and operation; better automobile mileage, industrial self-regulation of electricity
4. Government Role	Remove or reform governmental controls, i.e., tax subsidies, leasing policies, rate making by utilities; encourage appropriate R&D; create tax incentives
5. Environmental Impact	Lessened by not requiring massive development of coal and shale, offshore oil, and nuclear power. Pursue air quality regulations and pollution taxes
6. Lifestyle Implications	inimal--most changes are effected at the technical level. May be some energy price increases

SECTION I

ACTIVITY II

POSITION PROFILE #2

1. Impediments:

   a. Slowdown of leasing; price controls and new taxes on oil; litigation; local opposition; environmental fears; expecting too much from conservation. Social sectors: U. S. government, environmentalists, extremists.

   b. None

   c. None

2.

	MOBIL CORPORATION POSITION
1. Energy Supply Fossil Fuels	Develop coal, oil, and natural gas
2. Energy Growth	No limit on energy growth
• Alternative Energy Sources	None
• Hard Technology Sources	Use all available technologies and develop new ones
3. Role of Energy Conservation	A "useful tool"; proposes no specific measures
4. Government Role	Lessen restrictions on exploration and development of coal, offshore oil and nuclear power; lift price controls
5. Environmental Impact	Cites good record of oil spills and nuclear accidents; believes in "balancing environmental protection with needs of the economy for energy"
6. Lifestyle Implications	Energy policy should not restrict freedom of choice as to housing, automobile, vacation, etc., i.e., should have no lifestyle implications

SECTION I

ACTIVITY II: POSITION PROFILE #4

1.

a. physical realities: grant power stations, transmission towers, stripmines, arctic and offshore oil and gas wells, huge refineries; economic realities: capital and energy intensive nature of both synthetic fuels and electrification, monopoly of investment capital, supports fewer jobs; environmental risks: mining destruction to land, carbon dioxide in the atmosphere, accidents; socio-political risks: terrorist attacks, dissent, increased state and federal regulations, international implications, loss of equity.

b. Saving wasted energy; increase energy efficiency; changing consumption patterns; insulating homes; recycle scrap metals; cogeneration; solar devices; manual transmissions; radial tires; smaller vehicles; carpooling; mass transit; greater use of railroads.

	GEORGIA CONSERVANCY POSITION
1. Energy Supply Fossil Fuels	We need to effect a transition from our dependency on fossil fuels, a "rapidly declining non-renewable energy base"
2. Energy Growth	We cannot support unlimited energy growth
• Alternative Energy Sources	Solar power is an ideal energy source; use energy we waste
• Hard Technology Sources	See physical, economic, environmental, and socio-political drawbacks listed above (1a)
3. Role of Energy Conservation	Keystone to position: see list of measures proposed in 1b above
4. Government Role	Decentralized energy systems would be less vulnerable to terrorism; remove subsidies for non-renewable fuels; place royalty on non-renewable fuels; support energy efficiency
5. Environmental Impact	Risks of giant energy technologies are forbidding in terms of environmental destruction, pollution, and potential accidents
6. Lifestyle Implications	Rediscover neighborhood and community; make energy consumption "trade-offs" to effect conservation measures

SECTION II

ACTIVITY I:

1.

a. Motor vehicles: I (0); II (7,612,940); III (34,849,134); IV (56,221,089).

b. Power input: I (65,045,000 HP); II (459,000,000 HP); III (2,759,018,000 HP); IV (5,726,886,000 HP).

c. National concerns: I (World War I; influenze epidemic; income tax; prohibition; Russian Revolution; Panama Canal); II (Depression, World War II); III (Korean War; The Bomb; ICBM; Sputnik; Cold War); IV (Vietnam; nuclear energy; computers; racism; urban dissolution; suburban sprawl; The Establishment).

d. Transportation/recreation: I (horse, train, ship/Mah Jong); II (cars, trains/radio, parades, picnics); III (cars, planes/radio, matinees, comic books); IV (cars, planes/TV, movies, increased mobility).

2. a. Inputs: TV police shows; Star Trek; 2001; Beatles; psychedelic rock shows; The Graduate; Midnight Cowboy; Watergate, Nixon resignation; Munich Olympics; Joe Namath; Pele; Billie Jean King; Super Bowl; Mohammed Ali; computers; videotape recorders; lasers; communications satellite; solar energy; TV characters; sports superstars; astronauts; Timothy Leary; Malcolm X; "Eastern" religions; Jesus movement; communes.

b. Imprints: Vietnam War; Man on the Moon; drug culture; "hippies"; New York "black out"; Newark/Detroit race riots; heart transplants; Martin Luther King, Jr. and Kennedy assassinations: Earth Day; Pentagon Papers; Watergate.

3. Discussion to include:

a. Finite resources in short supply and expensive; possible "trade-offs" required in lifestyle choices; question of government's role and individual responsibility with respect to resource utilization.

Discussion to include implications of:

b. Faster communications and travel; space exploration and colonization; desire for greater mobility; need to conserve some resources; population increase; limited food supply; health and the environment; increased life expectancy.

SECTION II

ACTIVITY II (Reading I):

1. Model Exploiter: specialist, expert, efficiency, money, profit, maximum production, earn as much as possible by as little work as possible, concern for organization, thinks in terms of numbers, quantities, salesmanship, work as a burden, Model Nurturer: non-specialist, care, health, lost production, concern for carrying capacity of land, work as well as possible, concern for order, thinks in terms of character, condition, quality, kind, craftsmanship, work as fulfilling.

2. Their intent is to protect and preserve our resources and would not use them; they have no idea about engaging in a "living relationship" with the land; they are concerned with recreational goals and environmental disasters and often see man apart from the land rather than working with it.

3. We need places to go to restore the memory of our biological and cultural roots--in nature. We need the experience of leaving something alone, allowing certain places to influence rather than the opposite. We need a model in wilderness so we can see how it was and be able to tell how it is.

SECTION II

ACTIVITY II (cont'd) (READING II)

1.

a.

- Allow "rights" under Law to natural objects themselves, not only as they are represented by humans whose rights are threatened.
- Provide for guardianship for both public natural objects and private land. A guardian would be given rights of inspection and rights to seek redress. This approach would secure an effective voice for the environment.
- Establish realistic damages in terms of environmental cost and allow natural objects to be "beneficiaries" of awards.

b. Esthetic improvements may "cost" us, i.e., reduce our standard of living as measured in terms of our present values. Those who have certain material comforts may have to forfeit them while others may need to abandon the hope of acquiring them. We need to take into account depleting energy and food supplies and curtail growth (including population growth). Some benefits would be the re-definition of goals and needs in terms of an "environmental consciousness", learning again how to live with nature, discovering the interrelatedness of all life processes, planning for the long-term future, enlarging our scope of consideration to "spaceship earth".

2.

a. A resource use ethic would be established, monitored by "guardians" and upheld by the courts. Abused resources would be restored.

b. Curtailing energy resource exploitation and depletion would mean implementing a conservation ethic in both individual and aggregate lifestyle practices.

c. Individuals would act as guardians to resources, would be bound by law to respect rights of natural objects.

d. Equal rights for the systems of humanity and the systems of nature--right to redress of grievances and monetary compensation. Equalized access by every societal sector to resources and resource products.

SECTION II

ACTIVITY II (cont'd)

1. Depletion of fossil fuel base, no more cheap energy, need to conserve material resources, need to develop alternative energy resources, devaluation of human work, low health standards, environmental quality and inefficient industry.

2.

"New Values"	Past and Present Values
Stewardship	Progress
Austerity	Affluence
Permanence	Profit
Responsibilities	Rights
People	Professions
Betterment	Biggerment
Enoughness	Moreness
Localization	Centralization
Equitization	Urbanization
Work	Leisure
Tools	Machines

SECTION II

ACTIVITY II:

SUMMARY

a. Limited amount of energy and material resources.

b. Equal access to and fair distribution of resources and products.

c. Caring for limited resources, using skill to achieve quality of life.

d. To use something in a manner so as to preserve it.

e. Use simple and power-efficient tools, more labor-intensive instead of energy-intensive.

f. Non-specialization, work as fulfillment, part of individual and community goal, a chance to share.

g. personal decision-making with respect to resource use, role as a guardian of resources, participation needed to check and balance institutional power.

h. We create the future; present decisions should reflect long-term goals and quality of life for future generations.

i. Centralization costs more energy to operate and is removed from local resource base and individual consumer/decision-makers; more vulnerable to terrorist or single disaster shut down: decentralization questions alleged benefits of scale, emphasizes quality of service and individual participation.

j. Have realistic dreams; re-define material "wants" to be closer to actual "needs"; begin to think of energy "trade-offs".

SECTION 3

ACTIVITY I (Reading I):

1. Human nature revolts against inhuman technological, organizational, and political patterns; the living environment which supports human life gives signs of partial breakdown; virtual exhaustion of non-renewable resources in the foreseeable future.

2. Mass production is based on sophisticated, highly capital-intensive, high energy-input dependent and human labor-saving technology; a great deal of capital investment is needed to establish one single work-place. Production by the masses mobilizes human skills and supports them with first-class tools, is conducive to decentralization, compatible with the laws of ecology, gentle in its use of scarce resources and is designed to serve the human person.

3. Forward stampede: use current methods and more of them, complete modern technology, "more, further, quicker, richer," regulate against pollution, use synthetics instead of natural materials, develop breeders and fusion.
   Home-comers: search for a new lifestyle, return to basic truths about man and nature, redirect technological development, support Economics of Survival, equity and non-violence to either man or nature, take stock and find a new orientation.

4. It will produce second-rate products; capital-intensive workplaces achieve the quickest possible economic growth rate, increasing the capital per worker increases the output; shortage of entrepreneurial ability in under-developed countries; products would require protection within the country and would be unsuitable for export.

5. One: transformation of traditional technology using knowledge of advanced techniques; Two: adapt and adjust advanced technology to meet requirements of intermediate; Three: direct effort to establish intermediate technology against a background of advanced technology.

SECTION 3

ACTITIVY (READING II)

1. Shortage of energy resources and raw materials, pollution, rising material demands of underdeveloped countries, periodic famine, terrorism, nuclear proliferation, the poverty of abundance, leadership challenge, loss of social purpose, urban fiscal crisis, no meaningful work roles, unemployment, bureaucratic management, demand for equity.

2. Values: Simplify material aspects of lifestyle, share wealth with underdeveloped countries, less dependent on institutions, preference for human-sized living and working environments, ecological awareness, personal growth.

   Consumption patterns: purchase more labor-intensive products, handcrafted and durable, less on credit.

   Institutional operations: less dependent on complex bureaucracies, greater local self-determination, more institutional diversity.

   National policies: sense of social responsibility toward other nations, i.e., share resources, global citizenship, equitable access to resources.

   Global environment: support for international bodies, reduction of trade barriers, more cultural exchange, increase moral leadership.

3. It does not cure the problems we confront; it provides a basis for appropriate and successful problem resolution.

SECTION 3

ACTIVITY (READING III)

1. Hard path: expansion of centralized high technologies to increase supplies of energy, especially in the form of electricity, short-term emphasis.
   Soft path: efficient use of energy, development of renewable energy resources, conservation, long-term planning, increased efficiency, transitional fossil fuels.

2. Technical fixes: by using thriftier technologies to produce the same output of goods and services by substituting other resources for energy, e.g., thermal insulation, heat pumps, better gas milage.

   Cogeneration: uses steam produced in industry to generate electricity; industry could meet about one half its electricity needs by this means.

3. Schematic: continued increase in energy use; 155 Quads/year by 2000; uses coal extensively and relies on nuclear development.

   Alternate: rapid development of soft technologies; 100 Quads/year by 2000 and thereafter decreasing; uses soft technologies relying on renewable energy flows--sun, wind, vegetation.

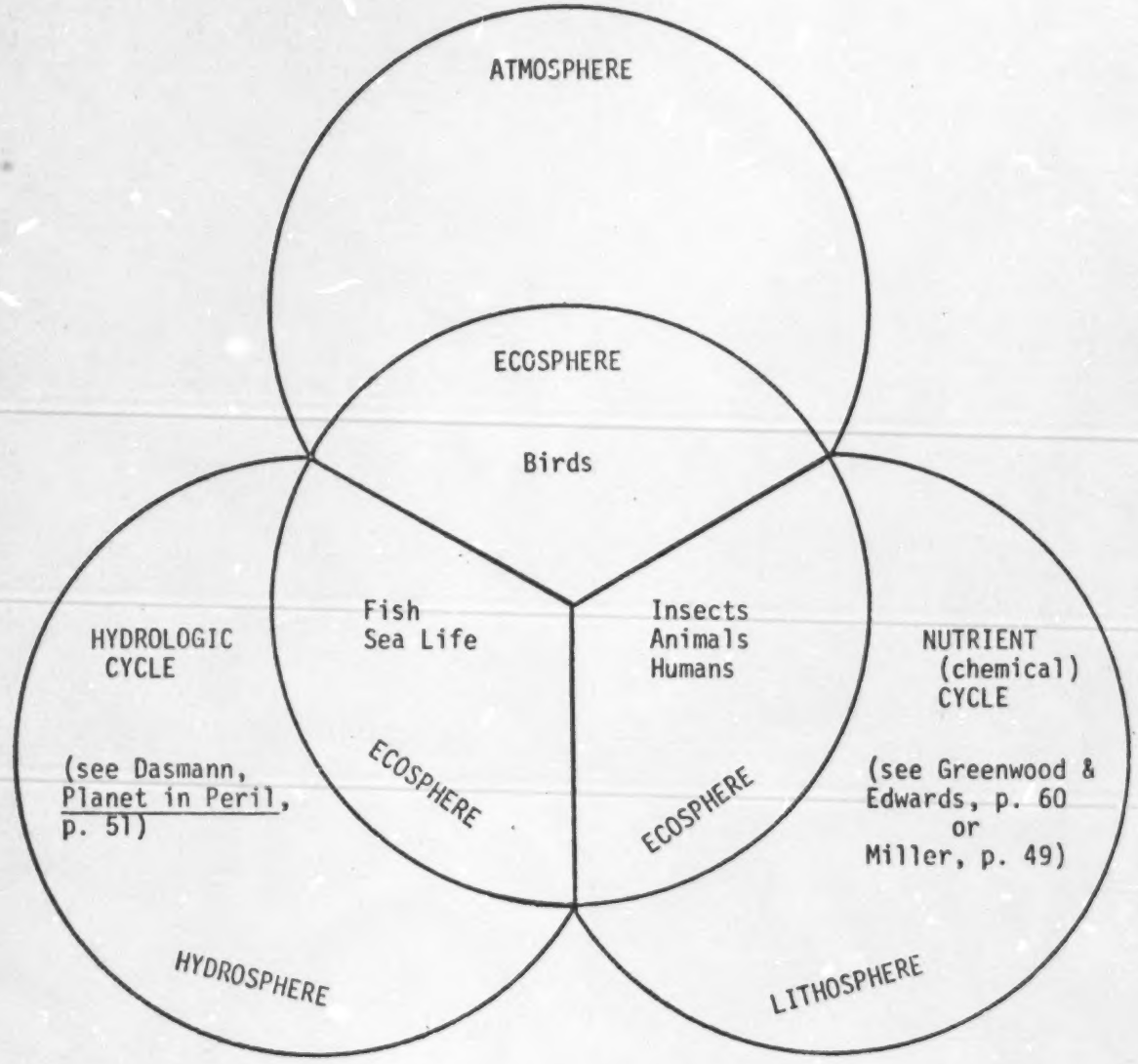
4. High quality energy such as electricity is wasted on tasks that do not require it, i.e., that could be accomplished using other energy sources. For example, cutting butter with a chainsaw or cutting meat with an electric knife.

SECTION 4

ACTIVITY 1:

This activity requires that you draw out or chart what you know about the major systems of our biosphere based on your review and summarization of the information presented in the specified readings (or any others you find useful).

The diagram which follows offers an incomplete example of what a drawing might look like.



EXAMPLE:

The HYDROLOGIC CYCLE links the other two systems in terms of condensation and precipitation (atmosphere), surface runoff, sub-surface water (lithosphere), and evaporation and transpiration (lithosphere-atmosphere).

ECOSYSTEMS form the central link between the 3 major systems since all life depends to varying degrees on a combination of air, water, and chemical nutrients.

SECTION 4 (cont'd)

ACTIVITY II:

1. Photosynthesis: sunlight (input)⟶oxygen (output; ↓radiated heat (energy loss)

   Food production: sunlight, water, seeds (inputs)⟶ wheat, corn, etc. (outputs); ↓ heat, wastes (energy losses)

   or

   agricultural produce, oil, machinery, labor (inputs)⟶bread, canned foods, etc. (outputs); ↓heat, wastes (energy losses)

   Automobile operation: gasoline, oil⟶mechanical motion/work; ↓exhaust heat

   Electric blender: electricity⟶mechanical motion; ↓heat

2. All the above processes tend towards disorder and loss of energy. Order can be maintained only when there is a large amount of potential energy remaining in the system and/or more energy coming into the system.

3. A farm system depends on the sun and rain for crop production and on the storage and re-use of wastes (manure, plant detritus, seeds) to fertilize and maintain crop growth.

SECTION 5

ACTIVITY I:

Sample chart provided in text on p. 117

ACTIVITY II:

Sample chart provided in text on p. 154

SECTION 5

ACTITIVY III

1. Recycling is the return of the bottle to the manufacturer for "remelting"; refilling is the reuse of the same bottle; refilling is more energy-efficient.

2. Raw material acquisition: less material required if glass bottle makes 8 return trips. Transport of raw materials: done only once for a returnable. Container manufacture: done once for a returnable. Transport to bottler: returnables require more space--storing and moving. Waste collection: throwaways require pick up, separation, sorting, etc. All need to be sorted, but breakdown (retrieving scrap glass) from throwaways is costly.

3. Inner-city dwellers: like throwaways because they shop on foot, have limited storage space, and find bottle returns embarrassing. Suburbanites: like returnables, travel by car, and influence the retailer.
   Retailers: throwaways reduce storage space and eliminate labor of sorting returnables.
   Bottlers: in soft drinks, throwaways can reduce profit (increased cost of unit and less sales); also corrosive qualities of soft drinks are sometimes not suitable for cans; large bottlers tend toward throwaways because of inefficient return shipping of empty bottles.

4. Reduce the energy demand by 55%.

SECTION 6

ACTIVITY I:

1. 66.6%

2. As income increases, so does indirect energy use.

3. a. Transportation shift from bus to bicycle or walking, insulate homes, spend less on medical care, clothing expenses and eating out; improve nutritional quality of food; conserve in utilities.

   b. Transportation shift from car to bus or train, change in food habits, alcohol and cigarette consumption, spend less on housewares, clothing, medical and recreation.

   c. Transportation shift from plane to car or bus, change from housing ownership to rental, change food habits, clothing, recreation.

4. $50,000 - most indirect energy purchases.

5. $4,000 - greater proportion of energy use is direct energy.

6. $50,000 - most indirect energy purchases.

ACTIVITY II:

No "answers" for this exercise.

ACTIVITY III (Economics Reading I):

1. "Cowboy economy": exploitative, violent, expansionist, frontier ethic, belief in consumption and production with throughput a measure of success, uses the GNP as a measure.

   "Spaceman economy": spaceship earth with finite resources; throughput should be minimized; measure of success is not production and consumption, but rather the quality of the goods and persons; recognizes a need for variety.

2. Use the concept of total capital stock rather than income-flow as a measure of success; break down the GNP to designate those products derived from exhaustible resources; recognition of a community in space and extending over time; prioritize future needs; value increased durability.

SECTION 6 (cont'd.)

ACTIVITY III (cont'd.) (Economics Reading II)

1. Neither buyer nor seller is responsible for anything but him or herself. The seller does not worry about customers in need; he tries to get the highest price for his goods. The buyer wants the cheapest goods no matter where they come from (except stolen goods). There is no social ethic for buyers and sellers to set or accept reasonable payments for goods or to accept responsibility for other people or the country's balance of payments.

2. Giving the priceless a price or to measure the immeasurable supports the notion that everything has a price; setting a monetary value on everything supports the notion that everything has a price and that "money is the highest of all values."

3. It would include the qualitative differences between the "goods" taking into account efficient resource utilization and environmental deterioration. It separates "goods" into distinct categories and would value them according to their "cost" in terms of resource utilization rather than economic profit. "Goods" are described as being primary and secondary. the latter depending on the availability of the former. Primary goods require either renewable or non-renewable energy resources. Secondary products are both manufactured goods and services. These are not of equal significance with respect to qualitative cost factors.

4. Labor/work gives a man a chance to utilize and develop his faculties, enebles him to join others in a common task and produce needed goods and services; work and leisure cannot be separated; work should be meaningful.

   Goods are of less concern than people; the quantity of goods is secondary to the quality of those goods; the proper conditions of work supports creative work and quality goods.

   Consumption: the aim should be to obtain the maximum of well-being with the minimum of consumption; a low rate of consumption supports non-violence, simplicity and self-sufficiency and resourcefulness.

   Imports/exports: produce from local resources rather than depend on imports from afar; satisfaction of wants from faraway sources signifies failure.

   Natural resources: supports a reverent and non-violent attitude toward all resources; considers value of resource in terms of renewability; acts of violence against nature will lead to violence between men.

SECTION 6 (cont'd.)

ACTIVITY III (cont'd.):

5. Both promote kindly use of resources, accept the notions of finite pie and equitable access to resources. Both support meaningful work and creative input by the individual, the use of tools when possible (instead of mechanical automation) and the development of appropriate technologies for humanity's well-being as well as for the protection and conservation of our resources.

ACTIVITY III (Political/Legal Reading I):

1. Conservationist politics is an outgrowth of the leisure industries, the politics of tourism, and for the most part are local efforts that rely on traditional pressure-group tactics. The concern is for preserving natural beauty rather than maintaining the balance of ecosystems. The new politics of ecology addresses the "trade-offs" necessary to approach ecological harmony, and calculates the hidden costs and side effects of our technology and material conveniences.

2. Changing lifestyle requirements, sacrificing certain conveniences, a revolution of declining expectations.

3. A new kind of party system and a new kind of legislative process that knows no territorial bounds and can deal with our technological and scientific problems within an ecological framework and on a more systematic basis.

ACTIVITY III (Political/Legal Reading II):

1. Issue administrative interpretations; ratification of violation; change the language of statutes; missing deadlines and letting timetables slip.

2. Doctrine of sovereign immunity; challenge plaintiffs' standing to sue; obtain the latest possible standard of review; test plaintiffs on the question of the exhaustion of administrative remedies.

SECTION 6 (cont'd.)

ACTIVITY III (Political/legal Reading III):

1. New technologies; new problems; new possibilities; new consciousness; new energies.

2. (1) Seek rich individual experience and be of service to others or seek material riches in terms of possessions and status?

   (2) Extension of "monolithic" institutions or be more self-determining?

3. Patriarchal attitudes, egocentricity, scientific single vision, bureaucratic mentality, nationalism and the big city outlook.

4. They are counterproductive: they cost more in money, energy, resources and time and offer less services. They foster over-dependence, giving up personal responsibility and active choice. They do not correspond to our natural rhythms, our responsibility to share the earth with other living things.

5. Grand scale, costly, use non-renewable resources, inflict environmental damage, difficult to maintain, difficult to understand, indifferent to surroundings, requires centralized authority.

   They are the opposite of a "Kindly Use" ethic that would conserve non-renewable resources, support human-scale technology, decentralization, meaningful work, individual responsibility and equitable access to resources and products.

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